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ABSTRACT

During the past decade there has been increasing public and political acceptance of the utility of inquiry and inquiry-related activities for bringing about educational improvement. Specifically, educational research, development, diffusion, and evaluation (RDDE) have been singled out as essential activities. This document presents the report of a study designed: (1) to develop a conceptual map representative of the functions (roles), tasks, and skills of educational researchers and research-related personnel; (2) to utilize the data generated in objective 1 in designing and developing multidimensional competence instruments and assessment procedures to ascertain the extent to which research and research-related personnel possess the identified competencies; (3) to inventory and describe current training programs in educational RRDE and their human and materials products; (4) to determine how many persons are needed to perform each function identified in objective 1, i.e., what is the demand for trained personnel to perform each function; (5) to revise existing manpower projections based on recent funding of RRDE activities; and (6) to synthesize existing manpower studies based on nonfinancial projections. (Author/HS)

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FINAL REPORT

Grant No. OEG-0-71-0617(520)

A STUDY OF SELECTED FACTORS RELATED TO THE TRAINING OF RESEARCHERS, DEVELOPERS, DIFFUSERS, AND EVALUATORS IN EDUCATION

NOVEMBER, 1971

U. S. DEPARTMENT OF
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November 1971

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Task Force on Training Educational Research
and Research-related Personnel

American Educational Research Association

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Reginald L. Jones
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Harold E. Mitzel
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Sam D. Sieber
Blaine R. Worthen, Chairman

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CHAPTER I

INTRODUCTION

INTRODUCTION

During the past decade there has been increasing public and political acceptance of the utility of inquiry and inquiry-related activities for bringing about educational improvements. Specifically, educational research, development, diffusion, and evaluation (RDDE) have been singled out as essential activities. Financial support for all these activities increased dramatically during the 1960s and recent trends toward educational accountability have given added impetus to educational evaluation. The proposed National Institute of Education will place additional emphasis on research activities and on the construction of an educational knowledge base for the future.

Initially, the rapid accretion of RDDE activities demanded substantial increases in the numbers of qualified personnel to assume the many new positions created by new RDDE undertakings. This manpower shortage had at least two results: (1) new programs were initiated to train more RDDE personnel, and (2) in the absence of sufficient numbers of persons specifically trained in RDDE, other persons were pressed into service in RDDE positions with the hope or expectation that they could become sufficiently trained on the job to function effectively in RDDE activities. Employment opportunities for the relatively small cadre of persons trained specifically in RDDE were many.

More recently, financial support for educational RDDE has leveled off and, in many areas, has been reduced sharply. Many RDDE programs have been discontinued, positions eliminated, and RDDE personnel left to seek new positions. General deterioration on the economic scene has coupled with RDDE fund shortages to create a situation in which the number of applicants per position opening has increased in many areas and graduates of RDDE training programs have had an increasingly difficult time finding suitable positions. This has led many observers to the opinion that the market for RDDE personnel in education is, at least for the moment, glutted and "pre-service" training of such personnel should be de-emphasized. Others, however, have argued that it would be most unfortunate to allow temporary reductions in RDDE funds to direct energy and resources away from pre-service RDDE training and thus lose valuable lead time needed to prepare persons for new positions which will doubtlessly arise as new inquiry and inquiry-related programs are initiated in the field of education. Universities and colleges continue to develop new programs to prepare educational researchers, evaluators, product developers, information specialists, and the like.

Even if the arguments for de-emphasizing pre-service RDDE training prevail, however, such a "breathing spell" only allows a related problem to come into focus more clearly. It is becoming increasingly apparent through both casual observation and empirical investigations[1] that many educational RDDE role occupants are inadequately prepared for the positions they now hold. It is clear that many persons performing in RDDE roles are severely handicapped by their lack of skill and/or knowledge in substantive and methodological requisites in their areas of investigation. It is equally clear that even the RDDE personnel who are initially well-trained to engage in their respective activities are faced with obsolescence in a field almost devoid of viable programs designed to keep such persons abreast of new developments in their areas of specialization. The problem of obsolescence is especially acute in methodologies and technological developments in skill areas such as statistics (e.g., Bayesian theory) and computer technology which are essential tools in educational inquiry. Overall, there appear to be serious deficiencies in the initial preparation or updating of substantial numbers of RDDE workers, pointing to a need for increased in-service training efforts.

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[1] See, for example, Worthen and Byers (1970).

The American Educational Research Association (AERA) has attempted to meet the demand for in-service RDDE training by conducting during the past several years a number of Presessions of educational research training, each of several days' duration, prior to its Annual Meeting. The large number of persons who apply annually for admission into these sessions (and during the last year paid a significant registration fee) suggests that educational researchers themselves recognize their need for training in new methods and techniques and are active in seeking such training opportunities.

The development of high-quality RDDE training programs--whether preservice or in-service--depends on careful planning of the substantive and experiential content of the programs. Lack of knowledge about "training variables," however, is undoubtedly the greatest impediment to planning training programs which will not only provide sufficient initial training in RDDE but also provide sufficient inservice training to prevent obsolescence and continually upgrade skills. Definitive information is needed on many factors relating to RDDE training. For example, there is a pressing need to identify the functions and tasks RDDE personnel must perform and the particular skills and knowledge necessary to permit effective performance of these functions and tasks. There is also a critical need for approaches and techniques for assessing the competencies (skills and knowledge) of RDDE personnel and trainees in education. Another need is to ascertain as accurately as possible the present parameters of the educational RDDE community and identify the training programs and opportunities--both preservice and inservice--which exist therein. It is also necessary to try to determine how many new positions in RDDE will actually be available in the next few years. A related need is for a system which will monitor accurately the changing status of the entire educational research milieu as it relates to personnel, their training, and the competencies. It is also necessary to determine whether the results of existing studies relating to RDDE training can be synthesized to derive generalizations more useful to RDDE trainers than are the results of the studies when viewed individually.

The needs listed above require periods of study and/or development before alleviating activities can be operationalized. To begin to establish a relevant knowledge base and develop procedures to attack these problems, AERA established a Task Force on the Training of Research and Research-related Personnel In Education in 1969. Under support of a USOE grant, the first pilot year of the Task Force operation was devoted to exploring several strategies for collecting data related to training variables. Efforts were aimed at exploring training needs of educational RDDE personnel, describing methods for improving RDDE training efforts, and planning studies and developmental activities to satisfy several of the needs outlined above. Specifically, the pilot year activities enabled the AERA Task Force to delineate parameters and problems of RDDE training in sufficient detail to dictate specific data collection and developmental activities needed to develop solutions for many of the continuing problems facing those responsible for establishing and conducting programs for preparing RDDE personnel in education.

Several of the needs discussed above are reflected in the major objectives of the present study, which are listed below.

Objectives

The major objectives and sub-objectives of the Task Force project for 1970-71 are listed below.[2]

1. To develop a conceptual map representative of the functions (roles), tasks, and skills of educational researchers and research-related personnel.
    - 1.1 To develop a conceptual framework defining and delimiting the salient characteristics of, and interrelationships between, research, development, diffusion, and evaluation in education.
    - 1.2 To identify and delineate the functions (roles) that are required of research and research-related personnel and modify the above conceptual framework as needed.
    - 1.3 To identify and delineate the specific tasks that are required in the performance of each function identified in objectives 1.1 and 1.2.

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[2] Early in the project, the scope of work for the grant was renegotiated with the USOE, resulting in deletion of three objectives (objectives three, seven, and eight in the original proposal), addition of one sub-objective (4.3 in the present list), and minor modifications in others. At that time the Task Force also refined the original objectives, resulting in minor modifications in wording and subordination. However, the refinements did not cause substantive changes or procedural modification; these minor changes were introduced only to increase clarity and better represent the original intent of the Task Force in proposing the activities reported herein.

Although the final set of objectives listed above is not identical with those in the original proposal, the numbering of objectives used here and throughout this report is consistent with the numbering in the original proposal.

1.4 To identify and delineate the competencies (skills and knowledge) necessary to perform each task identified in objective 1.3.

2. To utilize the data generated in objective 1 in designing and developing multidimensional competence instruments and assessment procedures to ascertain the extent to which research and research-related personnel possess the identified competencies.

   2.1 To design and develop one pilot mastery test of certain competencies in RDDE.

   2.2 To design and develop questionnaires to assess RDDE students' and workers' perceptions of their existing competencies and training needs.

4. To inventory and describe current training programs in educational RDDE and their human and materials products.

   4.1 To determine how many formal programs exist specifically for training RDDE personnel in education (i.e., what opportunities exist for initial training or retraining of such personnel).

   4.2 To determine the characteristics of these formal training programs in terms of (a) number and educational level of trainees; (b) duration of training; (c) financial support; (d) program focus; and (e) experiences and courses provided or required.

   4.3 To produce a compendium including a brief description of each training program identified in sub-objective 4.1 above on characteristics such as those listed in sub-objective 4.2.

5. To determine how many persons are needed to perform each function identified (in objective 1); i.e., what is the demand for trained personnel to perform each function?

   5.1 To revise existing manpower projections based on recent funding of RDDE activities.

   5.2 To synthesize existing manpower studies based on nonfinancial projections.

6. To supplement the information yielded by attainment of objectives 1 through 5 above by synthesizing extant studies of educational RDDE personnel or studies of variables directly related to training such persons.

Overview of This Report

To attain the objectives listed in the preceding section, it was necessary to conduct several discrete research and development activities. Although all the activities are bonded together by a common feature--concern with the production of planning data or materials necessary to make decisions about priorities in RDDE training program development and implementation--separate activities were required to attain each objective and, in some cases, each sub-objective. Therefore, this larger report contains reports of seven distinct and separate (although interrelated) research and development activities. Each of these seven activities has been reported in a series of technical papers produced by the Task Force.[3] The technical papers represented interim reports and have been incorporated in edited form in this report.

To orient the reader to (a) the relationship between the objectives and the remainder of this report, and (b) the relationship of the technical papers to the various sections of this report, the following discussion is included. In it, each objective is discussed and the relevant technical papers and chapters in the present report are referenced.

Objective 1

Objective 1 and its subobjectives are interrelated and were appraoched as a group. Procedures relating to those subobjectives are discussed herein in Chapter II (and were reported previously in Technical Papers No. 18 and 23).

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[3] A list of technical papers by number, author(s), and title is included in the list of references at the end of this report.

Briefly, Chapter II contains a discussion of an effort to determine empirically the functions, tasks, and competencies required of RDDE workers through a series of "task-analysis" interviews and factor analysis of the resultant data.

Objective 2

Objective 2 comprises two sub-objectives which are reversed in the sequence in which they are presented in this report. Sub-objective 2.2 is directly related to objective 1 in that RDDE competencies identified through objective 1 activities were used as the basis for sub-objective 2.2 instrument construction efforts. Procedures relating to sub-objective 2.2 are presented in Chapter III (and previously were reported in Technical Paper No. 30). Chapter III contains a description of the development of an instrument to obtain self-report data on selected competencies from objective 1.

Procedures relating to subobjective 2.1 are presented in Chapter IV (previously in Technical Paper No. 29). Chapter IV includes a description of the development of a pilot test for assessing competencies of personnel in educational research, development, and evaluation.

Objective 4

Procedures relating to sub-objectives 4.1 and 4.2 are reported in Chapter V (previously in Technical Paper No. 24). Briefly, Chapter V contains a description of a survey to identify existing pre-service and in-service RDDE training opportunities in the United States.

Sub-objective 4.3 was attained through taking data on each program identified through the survey mentioned above and transferring it to a one-page description of that program for inclusion in a compendium of training opportunities. The resulting compendium appears as a separately bound appendix and is not discussed further in the body of this report.

Objective 5

Procedures relating to sub-objective 5.1 are reported in Chapter VI (previously in Technical Paper No. 25). That chapter contains a discussion of efforts to update the original Clark-Hopkins educational RDD manpower projections for 1974 in view of changes in funding patterns which invalidated many of the assumptions on which the earlier projections were based.

Procedures relating to sub-objective 5.2 are presented in Chapter VII (and were reported previously in Technical Paper No. 26). Chapter VII presents an attempt to identify, review, and synthesize RDDE manpower studies to try to identify trends in supply and demand of RDDE personnel in education.

Objective 6

Procedures relating to objective 6 are reported in Chapter VIII (and previously in Technical Papers 27 and 28).[4] That chapter contains (a) a description of a process used to identify, review, and critique all existing studies which were found to relate to training of educational RDDE personnel, and (b) a synthesis of the findings of those studies found to be methodologically adequate.

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[4] Technical Paper No. 27 contained two major sections: (a) a description of a procedure for determining the methodological adequacy of each study reviewed under objective 6, and (b) descriptions of each study included in the synthesis described above. The voluminous second section is not reproduced herein; however, Technical Paper No. 27 (referenced later in this paper) can be obtained through the ERIC system.

A Further Word of Orientation

Two further comments may be helpful to the reader. First, there is no final summary or concluding chapter in this report. The next seven chapters contain reports of separate research and development activities and each chapter contains its own summary or conclusions necessary to the report of that activity. Because of the discreteness of the seven activities reported in these chapters, providing an omnibus summary or set of conclusions would be inappropriate if not impossible.

Secondly, the style used in this report may differ somewhat in tone from that in the usual report of research. Kaplan (1964, pp. 3-11) points out the differences between "logic-in-use," the more or less logical operators used by researchers in conducting their work, and "reconstructed logic," an after-the-fact idealization of those operations--i.e., what the process *would* be if extracted and refined so as to remove all alogic or illogic. Most reports of research seem to present a reconstructed logic of how the study was planned and conducted. The many false starts, failures, and blind alleys that are so typical of the research process--and so much a part of the researcher's logic-in-use--are routinely excised from final research reports. The opposite strategy has been used in the present report. In the interest of forewarning others who may pursue similar investigations or developmental efforts of snares which have been encountered by the Task Force and staff, the pristine logic-in-use which guided each activity reported herein has been described as faithfully as possible. To do so, thus rendering the critic's task more simple, seems preferable to glossing over difficulties which were encountered in the conduct of the work reported in this volume.

CHAPTER II

AN ANALYSIS AND INTERPRETATION OF TASKS AND COMPETENCIES REQUIRED OF PERSONNEL CONDUCTING EXEMPLARY RESEARCH AND RESEARCH-RELATED ACTIVITIES IN EDUCATION

AN ANALYSIS AND INTERPRETATION OF TASKS AND COMPETENCIES REQUIRED OF PERSONNEL CONDUCTING EXEMPLARY RESEARCH AND RESEARCH-RELATED ACTIVITIES IN EDUCATION

One of the most serious impediments to efforts to plan or conduct training programs for research or research-related personnel in education is lack of knowledge about which particular competencies or skills are most important in conducting research and research-related activities. As part of a continuing effort to identify competencies that should be developed in training programs, the Task Force proposed a series of site visits and interviews designed to collect data on specific tasks and competencies required of exemplary researchers, evaluators, developers, and diffusers in the field of education.

Objectives

Earlier work of the Task Force included efforts to develop a conceptual framework defining and delimiting the salient characteristics of, and interrelationships among, research, development, diffusion, and evaluation in education. (See Technical Papers No. 1 and 4 in the Task Force series.) These conceptual efforts also resulted in the identification of specific skills and knowledge in each of these areas which, on an *a priori* basis, seemed essential to effective participation in educational research and related areas (Technical Papers No. 1 and 5). Empirical data were then collected to see which of the skills were perceived by employers and supervisors to be necessary in conducting research, evaluation, development, and diffusion activities in education (Technical Papers No. 2 and 3).

Although the above procedures yielded useful data, they also brought to light three serious limitations. First, there was no empirical basis for selecting research, evaluation, development, and diffusion as the general categories within which to classify inquiry activities. The categories were selected because of their common use in the literature and because they seemed intuitively to encompass most of the activities relevant to inquiry in education. That is, the categories may reflect unknown biases of the educational research community to a greater extent than they accurately reflect actual classes of inquiry activities.

Second, the listed skills also lacked an empirical base, resulting in the same possibility for bias as that discussed above.

Third, employers' perceptions (in responding) were restricted at least in part to the categories and skills provided to them as referents. Although open-ended questions were posed to provide opportunities for additional responses, it seems likely that by using research, development, diffusion, and evaluation (RDDE) as organizing rubrics in collecting data, employers likely were restricted in some unknown degree from responding beyond the framework imposed on their thinking.

The procedures described here were designed to collect data not subject to the above limitations. Specifically, it was thought that the most defensible approach would be to conduct task analyses of what persons engaged in educational inquiry activities actually did on their jobs. By aggregating data from numerous task analyses and analyzing these data it was hoped that clusters of competencies and tasks might emerge that would serve to delineate clearly the major classes of research and research-related activities. By not imposing the a priori classification of RDDE on the data, it was thought that analyses of the data might serve to (a) verify the RDDE classification (if four such clusters emerged from the data), or (b) identify new clusters of competencies and tasks which would define inquiry functions other than RDDE. Consequently, an "open," unbiased methodology was evolved to meet the following objectives (excerpted from the objectives listed earlier in this report):

> 1.1 To develop a conceptual framework defining and delimiting the salient characteristics of, and interrelationships among, research, development, diffusion, and evaluation in education.
>
> 1.2 To identify and delineate the functions (roles) that are required of research and research-related personnel . . .
>
> 1.3 To identify and delineate the specific tasks that are required in the performance of each function identified . . . (in Objective 1.2)
>
> 1.4 To identify and delineate the competencies (skills and knowledge) necessary to perform each task identified in Objective 1.3.

Work on Objective 1.1 was reported earlier in Technical Paper No. 4 in the Task Force series (Glass and Worthen, 1970), which also appears as Appendix F in a previous OE report (Worthen and Byers, 1970). Work on Objectives 1.2, 1.3, and 1.4 is reported in the remainder of this chapter.

Uses of the Data. The data acquired in this study have a variety of uses, some of which are listed below:

1. The data will be of value to the U.S. Office of Education and other funding agencies in more precisely identifying (a) the inquiry functions (roles) actually required in the field of education, (b) the tasks which must be performed in relation to each function, and (c) the competencies (skills and knowledge) essential to conduct each task. This information will provide a basis for making more informed decisions concerning the type of training programs that should be funded than has been possible in the absence of such data.

2. Descriptions of essential competencies will be of value to directors of training programs in determining what knowledge and skills should be included in the content of their training programs.

3. Descriptions of essential competencies will be useful to AERA officers in determining what knowledge and skills should be included in the AERA presessions and in-service training programs.

4. Employers who have identified the tasks required of prospective employees but are unsure of the competencies required in each of these tasks can use these data as a basis for attempting to determine if a prospective employee has the competencies necessary to perform adequately on the job.

5. The data acquired through procedures described herein will serve as baseline data necessary to the attainment of several subsequent objectives in the Task Force project.

Definition of Terms

Before discussing procedures designed to attain the above objectives, it is necessary to define the terms "competencies," "tasks," and "functions" as used herein.

"Function" is used as a descriptor for a broad range of activities or tasks which taken together lead to the attainment of a particular inquiry goal (e.g., to produce generalizable knowledge about educational phenomena). Examples of function are research, development, diffusion and evaluation, although these four functions are not taken as givens for this study; the task analyses may identify tasks which are found to group together in ways that require different function labels.

"Tasks" are specific activities which are essential in the conduct of each function. Examples of tasks are defining a research problem, writing a final report of an evaluation project, preparing a script for a film, or analyzing data.

"Competencies" are the specific knowledge and skills used to engage successfully in each task. For example, a data analysis task might require (among others) the following competencies: knowledge of analysis of variance, knowledge of computer operations, the ability to select the appropriate statistical technique, the ability to select the appropriate computer program, and the ability to interpret the results of an analysis of variance.

To a large extent, the three words "function," "task," and "competency" simply express levels of specificity rather than different basic ideas. A function is basically a collection of tasks, as a task is composed of a number of competencies, in that a task can be described by the specific competencies of which it is composed.

Development of a Data Collection Technique

At the time the Task Force proposal was written, it was not known if appropriate instrumentation existed to collect the type of data specified above. Therefore it was necessary to use a variety of information sources to attempt to identify extant instrumentation adequate for the purposes described. The results of that information search are summarized briefly below.

"State of the Art" of Relevant Instrumentation

Task analytic approaches seemed most likely to be useful in collecting data required to meet the objectives listed above. Standard library search procedures and standard information services (e.g., ERIC, SIE, DATRIX) were used to identify information on task analysis, job analysis, employee performance rating, etc. Numerous references were identified and read and work that appeared relevant was followed up by letters or telephone calls to authors to (a) learn of any new work in the field, and (b) obtain opinions of experts as to what data collection technique would most suit our needs. No attempt is made here to review all the literature perused by the project staff or to describe all contacts with experts in task and job analysis. This section contains a brief summary of general threads of the search and a few representative studies.

A management orientation that emphasizes performance rating, wage scales, and man-machine efficiency pervades most of the literature on task analysis. Task analysis for industrial workers, including technicians, has been fairly well developed while the difficulty of such analysis of the work of professionals is indicated by its lack of availability.

Of the various approaches reviewed, the eclectic Air Force technique, (Morsh, 1961) based on the administration of duty and task inventories, is the most complex. Essentially it consists of (a) administering a checklist with tasks listed under each duty and a provision for adding tasks not already liste and (b) obtaining ratings on two items -- time spent and training and experience required. A typical approach (Morsh, 1963) involves extensive development work, including a tryout with as many as 100 or more workers, before administering the inventories to large numbers of people in Air Force installations around the world. The Air Force and other government agencies actively employ this approach in current activities (e.g., Christal, 1969; Brumback, 1969; Mayo, 1968 and McCormick, 1969) and the emphasis remains on evaluating job performance with the intent of assisting management of operations.

Except for the task analysis research being done by the Air Force, little has been published recently. Among the older sources are various industry-oriented studies such as Plant (1946) in which a questionnaire was used to elicit self-reports from sales and clerical job incumbents. More recently, Miller (in Gagne, 1962) distinguishes between task description and task analysis; description details requirements of the job while analysis refers to the skills required. His approach is within a man-machine system framework that is conducive to the development of minutely detailed analyses including the timing and frequency of a task. A somewhat different purpose is served by McCormick and Palmer's factor analytic studies (Palmer and McCormick, 1969) of checklist data relating to worker activity dimensions. They concluded that various human work activities may be organized with greater simplicity and economy in terms of a smaller number of relatively independent dimensions. A more recent approach, listed in a casebook of industrial job analysis procedures (Dalton, 1970), has a job-requirement orientation with the emphasis on efficient allocation of personnel to tasks.

Unfortunately, none of the above lines of investigation proved to have much utility for the present study, either in the opinion of the Task Force staff or in that of the task analysis experts who were consulted. The consensus of both groups was that instrumentation tailored to produce the type of data needed would have to be developed by the Task Force.

One Relevant Approach to Instrumentation. One relevant data-collection methodology not identified through the search procedures outlined above is that developed by the Oregon State Department Teaching Research Division in conjunction with their OE-sponsored project on research training. That methodology was reviewed by Task Force staff as part of a continuing liaison between this project and the Oregon study. The Oregon methodology was found to be aimed at the collection of similar data, but there were several ways in which the Oregon focus differed from that of the Task Force project. Most of the differences were attributable to either (a) the more extensive financial support for data-collection on the Oregon study than was available for the Task Force study, or (b) the relatively less comprehensive focus of the Task Force study. For example, the Oregon study included repeated visits to data-collection sites, the maintenance of daily logs by site employees for some time before the visit of the data-collection team, etc. Through such techniques, the Oregon group intended to investigate the full scope of inquiry activities on a specific project at each selected site, resulting in a complete case study of each project. The case study would contain data on how personnel interact with one another, the nature of the project setting, and the administrative procedures followed. The investigation of sensitivities (what may be termed "affective competencies") which are part of RDDE work was an additional dimension of the Oregon study. The methodology employed interviews that were both intensive and lengthy, with two major interviews of several hours being conducted (on different days) with each interviewee.

The financial constraints on the Task Force project did not permit the use of a technique that required as many human and material resources as that employed on the Oregon Study. In addition, the Task Force objectives were not concerned with sensitivities, administrative procedures, personnel interactions, etc. The focus was exclusively on tasks performed by research and research-related personnel and the skills and knowledge required to perform those tasks. Therefore, it was necessary to develop for the Task Force project instrumentation for use in collecting detailed data about a relatively small part of the overall field of concern in the Oregon study.

Development of the Initial Interview Procedure

The interview procedure developed for this study was expected to meet the following criteria:

1. The procedure must be sensitive enough to enable interviewers to obtain complete data on the research and research-related tasks, skills and competencies of each interviewee.

2. The procedure must be reliable in that the interviewer's interpretation of the information provided by the interviewee will be consistent with the interpretation of a different interviewer who listens to a tape recording of the same interview.

3. There must be sufficient standardization of the procedure to meet the interscorer agreement requirements identified above, yet sufficient open-endedness to permit the interviewee to provide a full list of his tasks and competencies in a free-response manner rather than by selecting from a predetermined list of such tasks and competencies.

4. The data obtained must be in a form that makes data compilation and analysis manageable.

In the development of such a data-gathering procedure, several approaches were considered and rejected, some after only a study of the literature and others after actual trial. Among the approaches considered were (a) direct observation of a person while he is on the job, using some type of job analysis system, (b) soliciting information via a questionnaire to be administered by mail and/or in a personal interview, and (c) several forms of a personal interview.

The review of related knowledge and practice showed that currently available job analysis systems are designed for rather systematic and well-defined jobs. They are particularly suited to improving the efficiency of a group of persons by aiding in the allocation of tasks to various people. Clearly RDDE work does not fall into this realm of systematic and well-defined activities.

Even as a supplement to a personal contact approach, the use of a mailed questionnaire was rejected, because of the expected low rate of response and the probable lack of carefully considered response to a questionnaire. The extensiveness and detail of the information required in our investigation ruled out this approach.

Early in the consideration of possible approaches, it became clear that some type of personal interview would be necessary. Among the various types considered were (a) the critical incident technique, (b) a highly structured interview in which the interviewee responds to predetermined categories on a checklist or interview schedule, (c) an interview based upon a log of activities which the interviewee would be asked to keep for a prior period of time, and (d) an open-ended or unstructured interview in which the interviewee responds to a series of open-ended questions designed to provide data for a rather structured data schedule. All but one of these approaches were rejected for reasons given below.

The critical incident technique could be used to solicit information on those job behaviors which led to exceptionally effective or ineffective outcomes in important parts of the interviewee's job. It was rejected without trial because of its failure to provide a complete compilation of all of the essential competencies employed by the interviewee. The use of an intensive interview based exclusively on a log of activities which the interviewee maintained over a period such as the two weeks prior to the interview was rejected without trial for two reasons: (1) the limited period of the interviewee's work time covered and (2) the probable lack of careful maintenance of the log by some interviewees.

The consideration of these various approaches finally led to the choice of an intensive interview designed to obtain a complete description of the tasks and competencies which were a part of the interviewee's work during a period of one year immediately preceding the interview. The major decision remaining was the degree of structure which the interview should have. Careful study and considerable trial-and-error work with various procedures were undertaken before the final decision was reached. One approach tried was based on a checklist developed from the lists of skills compiled in earlier Task Force work (Technical Paper No. 3). One difficulty encountered was the fact that those lists were found to be mixtures of both tasks and competencies and often one item in the list subsumed several others. The approach was rejected for a more basic reason, however -- the fact that the list originated through logical (armchair) analysis of leading RDDE personnel rather than through studying the actual tasks performed and competencies required for RDDE personnel on the job. It was decided that an open-ended approach should be employed to collect data on actual on-the-job tasks and competencies. At the same time, the data produced by the open-ended technique would have to be susceptible to extant data compilation and analysis techniques. These considerations led to the development of an initial interview procedure -- a procedure based on a series of open-ended questions designed to provide data for a structured data schedule and a previously designed system of data analysis.

Critique, Revision and Tryout

No attempt is made here to describe the initial interview procedure, since it is quite similar to the final procedures described below. The changes between the initial and final interview procedures came about through three activities: (a) a critique of the initial interview procedures by the AERA Task Force on Research Training, (b) revision of the interview procedures by the project staff, and (c) a tryout of the revised interview procedures with twelve persons engaged in educational research and development. The tryout data indicated that the revised (final) interview procedures could be used to meet the objectives for which the instrumentation was designed.

Description of the Final Interview Procedures

The final interview procedure was designed to obtain from each interviewee (a) a list of all of the different inquiry or inquiry-related tasks which he performed during the period of one year prior to the interview and (b) a list of the competencies required of him to perform each of these tasks. The printed materials used in the interview included (a) the interview record form (single sheet) on which general information and a list of the year's major activities were recorded (see Appendix A) and (b) the interview data sheets (multiple copies) for recording the tasks and related competencies which were part of each of the major areas of activity (see Appendix B). A small portable cassette tape recorder also was used by each interviewer to record the interviews.

Specific Interview Procedures. After completing preliminary activities, such as setting up the tape recorder, the interviewer filled out the first half of the interview record form which required descriptive information such as names, titles and dates. The interviewee was then asked to list the major projects or areas of activity in which he engaged during (a) the previous two weeks and (b) the rest of the previous year. Attention was directed first to the previous two weeks to obtain information that was as specific as possible for a period of time of quite recent memory and to establish a pattern in which the interviewee dealt with information as specific as possible.

The list of major areas of activity provided the framework within which the interviewer could proceed to obtain detailed information about tasks and competencies. After obtaining this listing, the interviewer asked for a description of each of the tasks which were part of each of the major areas of activity. Along with the description of each task, the interviewee was asked to identify each of the competencies he employed in accomplishing that task. Information about tasks and competencies was recorded on copies of the interview data sheets, with sufficient copies being used to record the tasks and competencies which were a part of all of the major areas of activity previously identified.

The "instructions to interviewers" given below provides a fuller picture of the specified procedures followed by the interviewers.

During the brief introductory discussion in which you develop rapport with the interviewee, explain that the interview is part of an extensive effort to ascertain the nature of the activities in which educational research and research-related personnel are engaged. Explain that the organization in which he is employed was selected as an exemplary center of research, development, diffusion and/or evaluation work and we would like to spend some time with him to ascertain, as clearly as possible, the tasks in which he is engaged and the competencies required to accomplish these tasks. Explain the need to tape record the interview and arrange the tape recording equipment.

After recording the preliminary information required on the first half of the interview record form, ask the interviewee to list the major projects or areas of activity in which he has been engaged during the past two weeks. If he has a daily calendar of his activities available, it may serve as a reminder of activities he otherwise might forget. These activities should be listed in the space provided on the bottom half of the interview record form. A name or phrase describing the activity is all that is needed at this point since this information will be used only as a means of facilitating the remainder of the interview.

The next step is to begin recording on interview data sheets the tasks and competencies which are related to the major activities mentioned above. Beginning with the first activity mentioned earlier, ask the interviewee to describe the various tasks in which he has been engaged as part of the activity. On the interview data sheets list these tasks and ask the interviewee to describe the competencies (skills or knowledge) required to perform each of these tasks.

It is not expected that the information solicited within the scope of a given activity will be acquired in any particular order. Information on several tasks may be acquired before specific information is acquired about the related competencies, or full information about the competencies for each task may be acquired before going to the next one. Full information within each major activity must be acquired, however, before proceeding to the next activity.

After you have reviewed the interview data sheets for a given activity to be sure you have acquired the information needed for that activity, proceed to the next activity listed on the interview record form. In the case of the second and subsequent activities, the procedure followed should be the same as the first with one exception -- the only tasks that need be investigated are those which have not been mentioned in earlier activities. Thus, a task should be recorded on the interview data sheets only once even though mentioned in connection with more than one activity.

After the above process has been completed, the interviewee should be led through the same process for other areas of activity and/or tasks in which he has been engaged during the past year but which have not been contained within the two-week period. This portion of the interview generally takes less time than the former part. The use of this two-part procedure focuses attention on the period of time which is more likely to be clearly remembered but also collects information about a period of time that may not be representative of the normal activities of the interviewee.

Since the focus of this study is research and research-related activities, functions such as teaching, administration, and consulting are outside the purview of our inquiry unless they contribute directly to some identifiable aspect of educational inquiry or inquiry-related activities per se. For example, an interviewee may serve as a consultant to a research project; we are interested in the tasks that he may perform in that role that are a part of the research effort. The teaching of a college course on educational research methods, however, is outside the scope of our concern since it is not generally a direct contribution to a specific identifiable research study. In the case of a director of a research project we are interested in his direct research administration contributions but not in general administrative functions such as building budgets, alloting work loads, and attempting to maintain staff morale -- duties that seem representative of any general administrative role. Another area of importance that is outside the scope of our efforts is the affective area, including such components as interest in research, curiosity, and tolerance of ambiguity. Although important in research and research-related work, they are outside the scope of this investigation.

You must use care to avoid suggesting responses to the interviewee. If an interviewee's statements are unclear to you, ask for greater detail rather than suggesting any response to him.

Training of Interviewers. Six interviewers were trained to conduct the interviews as described above. A set of statements to be used by an interviewer during an interview and based upon the ideas given in the set of directions above was written and used in the training process. Although the interviewer was not expected to memorize the statements and use them verbatim, their use in practice sessions encouraged uniformity among the interviewers. The training consisted of the following:

1. After extensive discussion with the developers of the interview procedure concerning its goals and mode of operation, each trainee listened

to a tape recording of an actual interview. Additional discussion followed and the process of listening to tapes and discussion of them was repeated until the trainee was judged to be prepared adequately for the next step in the training process.

2. The trainee then observed as one of the developers of the interview process conducted an interview, for training purposes, with a member of an RDDE agency. Observation of the interview was followed by discussion of the procedures employed. Again, the process was repeated until the trainee was prepared to conduct a trial interview himself.

3. Next, the trainee conducted a trial interview while being observed by one of the developers of the procedure. The critique of his interview which followed provided the interviewer with a basis for revising his approach. Repetition of this step continued until the interviewer was judged to be fully trained.

Sources of Data

In the view of the Task Force, it was paramount to interview persons who were doing exemplary work in educational research and research-related areas. The competencies possessed (and used) by good researchers, developers, evaluators, and diffusers were of primary interest.[1] Therefore, two strategies were used to identify persons doing exemplary work in all categories. First, the Task Force used ratings of 400 recent research articles to identify the 13 authors who were rated as doing the best research studies. These 13 persons were found to be widely scattered throughout the country and the interviews were conducted by telephone.[2] Second, 14 agencies were identified by the Task Force as doing exemplary work in educational RDDE. Knowledge of the quality of work generally came through first-hand experience of several Task Force members with each site, supplemented in some cases by information acquired through the 1969-70 telephone interviews with employers and supervisors in research and related institutions.

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[1] Interviewing unproductive researchers as a comparison group may provide useful data for a future study, particularly when the affective characteristics are considered. Such comparisons, however, were clearly beyond the scope of the present study.

Each of the 14 agencies was contacted and permission requested to conduct personal interviews with seven or eight of their staff sometime during January or February of 1971. Cooperation was received in every instance. The final list of agencies visited and the Task Force's *a priori* perception of the functional emphases within each agency are shown in Table 1. Within each of the organizations, a representative group of professional personnel was selected through consultation with the director of the project. The intent was to obtain a cross-section of the different types of personnel (e.g., evaluators, materials developers, and diffusers) employed at various levels (e.g., directors, professional full-time employees, assistants) within each exemplary setting. A total group of 116 persons was selected -- the maximum possible under existing budgetary constraints.

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[2] The interview procedure described above was found to need no modifications when interviews were conducted by telephone.

Table 1

Organizations Within Which Interviews Were Conducted And Perceptions of Functional Emphases in Each Agency.

	Research	Development	Diffusion	Evaluation
American Institutes for Research, Pittsburgh	P	P		
Learning Research and Development Center, Pittsburgh	P	P	S	
National Curriculum Projects, Boulder, Colo. (BSCS, SSEC)	S	P	S	
Southwest Regional Laboratory (SWRL), Los Angeles	S	P	P	
Research for Better Schools, Philadelphia	S	P	P	
New York State Department of Education, Albany			P	S
Nassau County BOCES Center, Jericho, New York			P	S
Columbus Public Schools Research & Evaluation Dept., Columbus, Ohio	S		S	P
Pittsburgh Public Schools Office of Research, Pittsburgh			S	P
Center for Instructional Research and Curriculum Evaluation (CIRCE), Urbana, Illinois	S		S	P
Educational Policies Research Center, Syracuse, New York	P			
Vocational & Technical Education ERIC Center, Columbus, Ohio			P	
University of Virginia Evaluation Center, Charlottesville	S			P
Montgomery County Public Schools Office of Research, Rockville, Maryland	S		S	P
Exemplary researchers identified as individuals	P			

NOTE: P = primary function and S = secondary function

Compilation and Categorization of the Data

Processing of the data began during the interviews in that (1) the interviewer made a written record of the interviewee's responses on the interview record form (see Appendix A) and interview data sheets (see Appendix B) and (2) the interviewer made some interpretations of the interviewee's remarks, i.e., he did not necessarily record them verbatim. Within 24 hours after the interview, the interviewer listened to the tape recording of the interview to check the accuracy of his written record. Additions, deletions, and modifications were made in the written record as necessary. All audio tapes and interviewee forms were retained for later compilation and analysis work.

Tasks. Prior to any analysis of the data acquired in the interviews, a system of classifying and compiling the data had to be developed and employed. The categories of research, development, diffusion, and evaluation (RDDE) are commonly employed to describe the activities of educational research and research-related personnel but there has been no empirical verification of the apparent logic and appropriateness of these categories for describing such activities. Rather than impose the RDDE rubric on the data collection process and collecting task and competency data within such a framework, the task and competency data were collected independently of any such set of categories. The intent then was to analyze task data to determine what groupings of tasks (i.e., functions) actually exist. The initial step in this analysis was the logical formulation of a set of

69 categories into which the entire collection of tasks from the 116 interviews could be classified. This set of categories was developed jointly by the six persons who previously had conducted the interviews. A list of the task categories and a description of each are presented in Appendix C.

After task categories were formulated, the interviewers coded each of the tasks identified in their own interviews according to the set of 69 task categories. For purposes of training in categorizing the data, twelve tape-recorded interviews were listened to and coded by the six interviewers (two interviews per interviewer). Then one tape, encompassing the broadest range and greatest number of tasks, was selected for conducting a reliability check. The six interviewers independently (1) listened to the taped interview and recorded the data on forms, and (2) coded the data according to the 69 task categories. Using analysis of variance[3], the average inter-judge reliability was computed on the classified tasks. The average inter-judge reliability was found to be .71. The results of this analysis are reported in Table 2.

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[3] Winer, B. J. Statistical principles in experimental design. New York: McGraw-Hill, 1962, pp. 124-128.

TABLE 2

Analysis of Variance: Inter-rater Reliability for Tasks

SOURCE	df	ms
Between Tasks	68	.56
Within Tasks	345	.16
Between Judges	5	.38
Residual	340	.15

$$r_6 = 1 - \frac{.16}{.56} = .71$$

Competencies. The compilation and categorization of the competency data were conducted in a manner similar to that described above for the task data with the exception that the coding of the data was done by one person. On the basis of the data from thirty interviews, four members of the project staff (two interviewers, the project director, and the data analyst) formulated a preliminary set of categories to use in classifying the competencies. To facilitate the categorization of competencies, twelve general categories were first formed. The specific competencies identified from the thirty interviews were then listed within the appropriate general category to which they belonged. The competencies for the remaining 86 interviews then were categorized by the coder, this person being one who had participated in the formulation of the preliminary set of categories and who, as an interviewer, had conducted the greatest number of interviews. The classification system was expanded slightly as the classification proceeded to allow for the appropriate inclusion of a few additional competencies that had not occurred in the first thirty sets of data from which the classification system was developed. The final set of 226 competency categories is presented in Appendix D.

A reliability check on the competency data was conducted in the same manner as that described above for the task data. One tape was selected as having the broadest range and greatest number of competencies. Competency data from this tape were recorded on the interview data sheets by the six interviewers. They then classified the data according to an initial form of the competency classification system and the six sets of categorized data were checked for reliability by the same procedure described earlier, resulting in an inter-judge reliability of .68. Results of this analysis are reported in Table 3. Although only one interviewer coded the data, the reliability check indicated that recording interview data on the forms was adequately reliable.

TABLE 3

Analysis of Variance:
Inter-rater Reliability for Competencies

SOURCE	df	ms
Between Competencies	109	.56
Within Competencies	550	.18
Between Judges	5	.55
Residual	545	.17

$$r_6 = 1 - \frac{.18}{.56} = .68$$

Each interviewee was scored on each of the 69 task categories identified in Appendix C. If the interviewee indicated that he had performed or was performing a given task, he was given a score of one. Otherwise the task score given was zero. These scores were assigned by the person who conducted the interview. The competency data scores were assigned in the same way as for tasks. However, for the competencies, the scores were assigned by the interviewer who was responsible for the categorization of the original competencies. The categorized data for both the tasks and competencies were transferred to computer coding sheets by seven specially trained clerks. A carefully supervised system of double checking the entire scoring procedure was employed to insure its accuracy.

Data Analysis Procedures

The analysis of the data obtained in the interviews was designed to attain the objectives described earlier in this chapter, i.e., to identify and delineate the functions, tasks, and competencies (defined above under Definition of Terms) which are required of research and research-related personnel.

As described previously, the interviews provided data on the tasks performed and competencies used by research and research-related personnel; no attempt was made to logically describe the functions these personnel performed. The initial facet of the data analysis was designed to find what "clustering" of tasks actually occurred. This in turn would define functions performed. The analysis involved a factor analysis of the task data.

The next step in the data analysis was to organize the 226 categories of competencies into groupings in terms of their common possession by research and research-related personnel. As with the analysis of the task data, the determination of groupings of competency data was facilitated by factor analytic techniques.

The final major step in the data analysis was to relate the competency factors to the task factors to determine what competencies actually are used in performing each of the task factors (functions) identified through the initial factor analysis. These three stages of the data analysis are described in greater detail below.

Factor Analysis of Task Data

The 69 tasks listed in Appendix C were factor analyzed to ascertain possible groupings and in this way acquire a more precise description of the functions -- collections of tasks -- performed by research and research-related personnel. The input variables consisted of 69 dichotomously scored variables on 116 subjects. Factor extraction was accomplished by a principal axis procedure; squared multiple correlations were used as estimates of the communalities.[4] An oblique transformation was performed using the Harris-Kaiser Independent Clusters solution. The factors to be transformed were selected using the Scree Test.[5] In addition to performing the factor analysis, simple frequencies for each task were obtained.[6]

The matrix of phi correlation coefficients among the 69 tasks is presented in Table E1 of Appendix E. The principal-axis factor extraction produced 48 factors (corresponding to the positive eigenvalues of the intercorrelation matrix of variables with squared multiple correlation coefficients along the diagonal) which accounted for 73.8 percent of the total variance. The results of the Scree Test (presented in Figure F1 of Appendix F) revealed that 12 factors, accounting for 45.4 percent of the total variance, should be retained for factor transformation. The results of the oblique transformation are presented in the next major section of this chapter, which includes the results of the data analysis.

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[4] The Biomedical computer program BMD03M, General Factor Analysis, was used for this computation. Dixon, W. J. (Ed.) BMD biomedical computer programs. Berkeley and Los Angeles: University of California Press, 1968.

[5] Cattell, R. B. (Ed.) Handbook of multivariate experimental psychology. Chicago: Rand McNally and Company, 1966, p. 241.

[6] The Biomedical computer program BMD04D, Alphanumeric Frequency Count, was used. Dixon W. J. (Ed.) BMD biomedical computer programs. Berkeley and Los Angeles: University of California Press, 1968.

Factor Analysis of Competency Data

The 226 competencies identified in the interviews with the 116 subjects were factor analyzed to determine possible competency groupings. Through matching these competency clusters with the task factors identified above it was hoped that it would be possible to identify the competencies (skills and knowledge) necessary in the performance of each general task factor. The analysis of the competencies was conducted across the general task factors obtained from the factor analyses of the tasks. Due to limitations in computer capabilities it was necessary to use a combination of both logical and empirical procedures.

The first step in this process involved the formation of three groups of competencies[7] from the total collection of 226. The intent was to group together in the same group those competencies that logically would be expected to be associated with each other. The three groupings were determined by the four members of the project staff responsible for the categorization of the original competencies. Several of the competencies were placed in more than one grouping. This resulted from the fact that the four members of the project staff felt that some of the competencies logically fit with more than one group. The three groups of competencies, identified as packages 01, 02 and 03 are presented in Tables E2, E3 and E4 of Appendix E.[8]

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[7] Since the factor analysis program could accommodate a maximum of 85 variables, an upper limit of 85 competencies per package was necessary.

The first package contains 64 competencies which for the most part are closely related to data analysis and computer operations. The second package contains 80 competencies which relate primarily to evaluation, conceptual and management-administrative competencies. The third package contains 85 competencies related to the development of curriculum materials, conceptual activity, inservice education and management-administration. Several competencies thought to be related to writing skills were included in both the second and third packages.

Each of the three packages was factor analyzed using the same procedure as previously reported for the task data analyses. The results of the factor analyses are reported in Appendix E. Tables E5, E6 and E7 contain the matrices of phi correlation coefficients for the three competency packages. The principal axis extraction (smc's along the diagonal) was used for packages 01, 02 and 03. Application of the Scree Test (presented in Figures F2, F3 and F4 in Appendix F) revealed that 8, 6 and 6 factors (accounting respectively for 42.4, 27.3 and 27.0 percent of the total variance) should be retained for factor transformation. Tables E8, E9 and E10 contain the respective factor pattern matrices, and Tables E11, E12 and E13 contain the correlations among the oblique competency factors for the three packages.

To permit the competencies in the three packages to be factor analyzed in one common analysis (within the computer constraints of 85 variables), the results of the initial three factor analyses were used to form a fourth package of competencies. The competencies included in the fourth package were selected according to the following criteria:

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[8] Thirty-eight competencies for which the frequency of occurrence was less than 6 -- i.e., fewer than 6 of the 116 interviewees listed the competency -- were not included in this analysis.

1. Competencies which had pattern coefficients above .35 in absolute value and which were in at least two of the three initial competency factor patterns were included.

2. Competencies which had pattern coefficients above .48 in absolute value and which were in one of the three initial factor patterns were selected.

3. Competencies were selected so that each of the factors in each of the three factor patterns was represented by at least two of the competencies which loaded on it.

Eighty-two competencies met the criteria above and were selected for inclusion in package 04; these competencies are listed in Table E14 in Appendix E.

A factor analysis of package 04 competencies was accomplished using the same procedures as reported previously for the analysis of the task data. The matrix of phi correlation coefficients among the 82 competencies appears in Table E15 in Appendix E. The principal-axis factor extraction produced 59 factors (corresponding to the positive eigenvalues of the intercorrelation matrix of variables with squared multiple correlation coefficients along the diagonal) which accounted for 80.2 percent of the total variance. The results of the Scree Test (presented in Figure F5 of Appendix F) revealed that seven factors, accounting for 33.5 percent of the total variance, should be retained for factor transformation. Identification and interpretation of the transformed competency factors is given in detail in the next major section of this chapter.

The processes described above resulted in a reduction from 226 competencies to 82 competencies. (Of the original 226, 38 were excluded because of low frequencies and 106 failed to meet criteria for forming package 04 above.) Since these reductions were largely caused by limits in computer capacity (e.g., necessity of holding package 04 to fewer than 85 competencies), procedures were employed to use the results of the statistical analysis (e.g., correlation matrices), supported where necessary by logical analyses, to place the 106 high-frequency competencies not previously included in package 04 within the factor pattern obtained for the 82 competencies in that package. The following three criteria were used in this process:

1. Factor analysis results from packages 01, 02 and 03. A competency not included in package 04, but present in package 01, 02 and/or 03, was placed with those competencies with which it loaded in the first three packages. For example, competency C301 was not included in package 04 but was included in package 01. In package 01 it loaded on the same factor and in the same direction as competencies C801, C807, C815 and C826. These latter four competencies were included in package 04, loading together on general competency factor 1. Therefore, C301 was placed, albeit *post hoc*, on factor 1.

2. First-order correlations. Some of the competencies not included in package 04, but included in packages 01, 02 or 03, did not possess large pattern coefficients (greater than .35 in absolute value) within the factor patterns for packages 01, 02 and 03. However, examination of their first-order correlations revealed that many of these competencies correlated meaningfully with other competencies included in package 04 and cut across several of the factors in the appropriate factor pattern in package 01, 02 and 03. In these cases, the competency was included in more than one

factor of package 04. For example, C212, originally included in package 01, was placed in general competency factors 1 and 2 of the factor pattern for package 04 because of its correlations with other competencies within these two factors.

3. Logical analysis. Thirteen of the original 226 competencies which met neither of the above criteria were placed on one of the seven factors using logical analysis. The four persons responsible for the analyses, working independently, placed each of these competencies on one or more of the seven general competency factors which resulted from package 04. Any disagreements were resolved at a meeting of the four persons, and final placement of these competencies reflected unanimous agreement of the four judges.

Results of this analysis are reported in the next major section of this chapter.

Relating General Competency Factors to General Task Factors

The third and final stage of the data analysis was the placement of general competency factors with the appropriate general task factors in order to identify those competencies necessary in the performance of each general task factor. This fit between task and competency factors was done on the basis of (1) the frequency of occurrence of the competencies in the performance of each task factor and (2) the results of the factor analyses. A frequency count of the occurrence of each competency in the performance of each task factor was performed. This provided a matrix (226 competencies by 12 task factors) in which one tally was entered for each person who employed a given competency in the performance of a given task factor. From these data the main relationships between competency factors and task factors were ascertained by the two-stage procedure described below.

Stage one. For each task factor, the most frequently occurring competencies were identified.[9] Of these "high-frequency" competencies, those which were contained in one of the competency factors (from the package 04 factor analysis) were then identified and the number of different high-frequency competencies present from each competency factor was identified. Those competency factors having the largest number of high-frequency competencies were judged to be the competency factors most frequently employed in the performance of the given task factor.

The number of competency factors identified with each task factor varied from one to three, the criteria for inclusion being the presence of three[10] or more of the competencies from the given competency factor in the group of high-frequency competencies under the task factor.

Stage two. Because the above process tended to favor those competency factors which contain a large number of high-frequency competencies at the expense of competencies which occur less frequently but may be concentrated on one task factor, a supplementary process was employed to identify any additional competencies that may have been omitted due to this bias. Twenty-six competencies from the seven competency factors were identified which had not occurred frequently enough under any one task factor to be included in the process identified above. For each of these competencies, an inspection was made to identify those competencies for which a large proportion of their occurrence was concentrated on one task factor. The specific criterion for inclusion was that the frequency of occurrence on a given task factor be at least twice as great as its next highest frequency of occurrence on any other task factor.[11] (In all cases, this frequency of occurrence also was greater than one-fourth of the total frequency of occurrence across all twelve task factors.) Finally, those competency factors which had two or more competencies identified with the same task factor were judged to be related to that task factor. This process resulted in the addition of two more task factor-competency factor pairings to the list of eighteen which resulted from the earlier process.

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[9] This number ranged across categories, from 10 competencies to 25 competencies; in all but one case, the number of competencies was between 18 and 25. In the case of one task factor, for which the competency frequencies were very low, their number was reduced to 10 to avoid inclusion of a large number of competencies with a frequency of one.

[10] In the case of two task factors for which the total number of competencies (from package 04 competency factors) was seven or less, this number was reduced to two.

The results of this two-stage process of pairing task factors and competency factors are contained in the next section.

Results of the Data Analysis

This section is sub-divided into three parts which contain: (1) the results of the factor analysis of task data, (2) the results of the factor analysis of competency data, and (3) discussion of attempts to relate the results of the task and competency data analyses.

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[11] One exception was a competency that had a frequency of occurrence of six on each of two task factors and a frequency of one on only one other task factor. As a result, it was identified with both task factors.

Identification and Interpretation of General Task Factors

The Harris-Kaiser Independent Clusters transformation of the twelve general task factors resulted in the oblique factor pattern summarized in Table 4. The twelve factors from this solution are identified below together with a listing and discussion of the variables which loaded on each factor. For the purpose of factor identification and interpretation, only tasks which had factor coefficients greater than .33 in absolute value are included.

Task factor 1. The principal loadings on factor 1 are from the following task variables[12]:

T49	Using computer facilities and services	.716
T46	Planning and/or selecting data analysis techniques	.669
T 3	Conceptualizing or formulating a problem or hypothesis for empirical studies	.472
T51	Interpreting, reviewing, and integrating the results of data analysis	.455
T 6	Formulating a design for a research study	.414
T47	Conducting data analyses by non-computerized methods	.391
T38	Conducting interviews	-.379
T43	Reviewing and critiquing extant educational programs and products	-.376
T48	Developing a computerized data bank and retrieval system	.374

Each task which loads positively on this factor is related to empirical research, with the heaviest emphasis being upon design and data analysis.

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[12] Task numbers, labels for each task, and loadings are shown under each task factor.

TABLE 4

Factor Pattern for Factor Analysis of Tasks (Harris-Kaiser Independent Clusters Oblique Solution)

TASK	FACTOR 1	2	3	4	5	6	7	8	9	10	11	12
T1	191						-137	522	-120	135		
T2						209	-179	639				147
T3	472			-142	-203			127	-257		271	-156
T4	-213	-208		-150	-500	158		181	-224	-108		
T5	-187	321	510		-114		-151	126	-101			-189
T6	414	-107	157	101					-189	387	136	
T7	195		-143	549						-156	-175	-103
T8		448	523			160	-108			108		
T9				671	159			112	-125			
T10		-157		460	139	120				-364		104
T11			275		-167	-118		-254	-380	-221	-130	
T12	154		539				141		220		163	
T13		190	370			124	124					
T14	-134	-277	443	-202	-181	-182	241		-225	-130	153	
T15		-136	574	183	122		121				136	
T16			263	-191	-164	-135		-252		-157	-197	-135
T17	150				335		234	110		495		
T18							754				-127	
T19							826					
T20	-187		346	160		232			149	-249	152	180
T21	190	127	584		140				-175			-118
T22	102								177		626	
T23	-138		222		289	-180		171	164	115	407	
T24		-261	288		-116			-102			441	
T25	162	633	125	141	-137							
T26		814					161			125		
T27	-227	-209		-140	-117	-188	-143	195			-162	114
T28		763	181									
T29		597		-173	325		-168		-143			189
T30		378		-151				-113			386	
T31	-104	237	-179	-144	106				-126	-249	460	
T32		-193		-244	105		178		-155	240	378	
T33	292		110	409	-196					-199	107	
T34	283	296		283						119		381
T35	129		133	572	-140			-130				

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown. Leading decimal points are omitted.

TABLE 4 (cont'd)

Factor Pattern for Factor Analysis of Tasks
(Harris-Kaiser Independent Clusters Oblique Solution)

TASK	FACTOR 1	2	3	4	5	6	7	8	9	10	11	12
T36				723		-122	-221			145		
T37												809
T38	-379	-106		366	-279	-132		124				324
T39		-122		429				-312		173		279
T40		270	-215	157						510		174
T41		167	-290	320	-190					109	401	
T42	152		-341	123	-373	152			-191			-247
T43	-376	223	-208	237	-219	-115	183	220		243		-116
T44	-168	463					-251			-271	111	
T45	109			-104	-116							523
T46	669		220	162						111		
T47	391		-158					-106	-182		142	205
T48	374		-124						294	-179		-222
T49	716		-112				104		171			
T50								-155	567			
T51	455		-133					137		-447		
T52	157	-104		-125			-102		654			
T53	319	-287		-114				142	-305			-154
T54		-174		151	382	-266		316		-231	-101	
T55	-254		-217		227		118	277		-177	119	-166
T56	194					-161		507		-143		
T57		-135			343	192			-208		192	
T58	-142	-171	115	167	538	254			-150			
T59		134	205	177			224	289	105			202
T60	202			-255	111			203		-335	147	218
T61					114	158	272	276	151	-240	196	-169
T62							464	-195		-177	-215	-118
T63	-220	236	-236	349			138	-125	-189	-281		-108
T64			-123	-205	361			-203	-291	-181		293
T65				-106		585		122				240
T66						891						
T67						811						
T68	125	-209		109			-131	-191	-277	129	368	125
T69						317	226			-170	259	
VARIANCE OF FACTORS	3.227	3.764	3.061	3.473	2.081	2.607	2.340	2.127	2.047	2.210	2.260	2.140

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown. Leading decimal points are omitted.

Tasks 49, 46, 47 and 48 all deal with some aspect of computer utilization or data analysis. Tasks 3 and 6 deal with formulation of a problem or research design, while the remaining variable with a positive loading, task 51, deals with interpretation of data and data analysis. Therefore, task factor 1 is named *designing research studies and conducting and interpreting data analyses*.

Task factor 2. Task factor 2 is named *developing instructional materials* in accord with the following variables which possess high loadings on it:

T26	Specifying and sequencing learning activities	.814
T28	Designing curriculum materials	.763
T25	Identifying and formulating educational objectives	.633
T29	Writing or revising printed curriculum materials	.597
T44	Field testing of curriculum materials	.463
T 8	Designing a specific educational development activity	.448
T30	Developing non-textual learning materials	.378

Each of these variables is clearly part of the process of developing instructional materials.

Task factor 3. The following variables loaded on this factor:

T21	Supervising professional personnel	.584
T15	Allocating human and material resources to activities	.574
T12	Formulating budgets and conducting cost-analyses	.539
T 8	Designing a specific educational development activity	.523

T 5	Identifying a product or program which needs to be developed	.510
T14	Engaging in executive planning and policy-making	.443
T13	Utilizing a PERT or other management planning system	.370
T20	Orienting, training and upgrading project personnel	.346
T42	Tabulating and categorizing data	-.341

Six of the eight variables which load positively on the factor, including the three highest loadings, refer to management or administration tasks. The other two with positive loadings (T8 and T5) are development tasks with an emphasis on those aspects of development in which a higher level administrator likely would be involved. Several of the positive loadings are on variables which have to do with broad-scale planning, policy-making and supervision. To distinguish this factor from task factor 11 (which is also an administration and management factor but focused on tasks that are characteristic of persons who have a lower level position in a project or program hierarchy), general task factor 3 is named *"first-level" administration of inquiry and inquiry-related projects and activities*.

Task factor 4. The highest loadings on this factor are from the following variables:

T36	Selecting or constructing and revising questionnaires, checklists, interview schedules, and observation systems	.723
T 9	Conducting, managing, or monitoring a formative evaluation	.671
T35	Selecting or constructing and revising measures of affect	.572
T 7	Formulating a design or plan for an evaluation	.549

T10	Conducting, managing, or monitoring a summative evaluation	.460
T39	Administering group tests and collecting data by use of paper and pencil instruments	.429
T33	Planning data collection procedures	.409
T38	Conducting interviews	.366
T63	Conducting inservice education programs	.349

The eight variables which load highest on this factor specifically refer to either evaluation tasks or data collection tasks which are, of course, a necessary part of evaluation activities. Although many of the types of data collection specified in the tasks (e.g., T36, T35, T39 and T38) are common techniques for collecting research data, their loading with evaluation tasks on this factor suggests that they may be used more frequently by evaluators -- indeed, some of these techniques may be among the evaluator's most useful tools. Therefore, task factor 4 is named _conducting evaluations and constructing and using data collection instruments_.

Task factor 5. The highest loadings on this factor are from the following variables:

T58	Disseminating information about activities on a specific project or in a specific agency	.538
T 4	Conducting philosophical and historical analyses	-.500
T54	Preparing and delivering a lecture or oral presentation on a research or research-related topic	.382
T42	Tabulating and categorizing data	-.373

T64	Translating written materials from one language to another	.361
T57	Preparing reports, educational materials, and other printed materials for mass production	.343
T17	Preparing RFPs and guidelines for preparation of proposals	.335

The largest loadings are related to tasks 58 and 4. There appears to be no compelling reason for these two variables to load, albeit in opposite directions, on the same factor.[13] However, in deference to the slightly higher (in absolute value) loading of T58 and the fact that the four remaining positive loadings are on variables clearly related to diffusion, task factor 5 is named *diffusing information and products*.

Task factor 6. The three principal loadings on this factor are from the following variables:

T66	Selecting and indexing documents for inclusion in information storage and retrieval systems	.891
T67	Writing abstracts of materials selected for inclusion in an information storage and retrieval system	.811
T65	Developing and modifying information storage and retrieval systems	.585

All three of these variables are tasks that are part of developing and operating information storage and retrieval systems such as ERIC centers. Thus, general task factor 6 is named *developing and operating information storage and retrieval systems*.

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[13] It could be that task 4 (and task 42) refer to activities more likely to be pursued by someone conducting research *per se*, an unlikely pursuit for a disseminator. However, this must be viewed as speculation at this point.

Task factor 7. The principal loadings on this factor are from the following variables:

T19	Processing proposals for funding and monitoring funded proposals	.826
T18	Reviewing and evaluating proposals submitted for funding	.754
T62	Conducting on-site evaluation visits	.464

The first two variables reflect activities engaged in by persons responsible for dispensing funds to support inquiry and inquiry-related activities in education. The analysis suggests that these same persons also conduct on-site evaluation visits to projects or programs which they have funded. Task factor 7 is named *evaluating inquiry and inquiry-related proposals and monitoring funded projects*.

Task factor 8. The variables which have the highest loadings on this factor are as follows:

T 2	Utilizing formal search procedures to acquire information	.639
T 1	Reading the literature and acquiring up-to-date information through other means	.522
T56	Reviewing and evaluating research and research-related reports	.507

The first two variables deal with the acquisition of information. The third variable is the task of initially reviewing reports and making judgments about the information in them. Therefore, general task factor 8 is named *searching, reading, and reviewing the literature*.

Task factor 9. Task factor 9 is named *designing and maintaining computer systems and writing computer programs*. The important loadings on this factor are as follows:

T52	Designing computer programs and programming	.654
T50	Designing computer systems, inspecting and diagnosing computer problems, and repairing computer equipment	.567
T11	Writing a proposal	-.380

This factor shows that the designing of both computer systems and programs, as well as the maintenance of systems and programming itself, tend to be done by the same persons. Such persons are typically specialists not involved in writing a proposal and, therefore, it is not startling that task 11 would load negatively on this factor.

Task factor 10. The following variables possessed high loadings on this factor:

T40	Administering individual tests	.510
T17	Preparing RFPs and guidelines for preparation of proposals	.495
T51	Interpreting, reviewing, and integrating the results of data analysis	-.447
T 6	Formulating a design for a research study	.387
T10	Conducting, managing, or monitoring a summative evaluation	-.364
T60	Negotiating with publishers and equipment manufacturers	-.335

It is not readily apparent why this subset of task variables loaded together on this factor. Consequently no name has been given to this factor.

Task factor 11. Task factor 11 is named *"second-level" administration of inquiry and inquiry-related projects and activities*. The principal variables loading on this factor are as follows:

T22	Supervising support personnel	.626
T31	Producing or supervising the production of curriculum materials in quantity	.460
T24	Designing and selecting facilities and capital equipment	.441
T23	Hiring and recruiting personnel	.407
T41	Using formal or informal observation systems to code human behavior	.401
T30	Developing non-textual learning materials	.386
T32	Repairing and maintaining equipment (other than computers)	.378
T68	Conducting a research study	.368

The first four variables have an administrative emphasis as indicated by their inclusion of supervision (T22 and T31), selection of facilities and equipment (T24), and hiring of personnel (T23). As noted earlier, this factor seems to have a somewhat different character than task factor 3, the "first-level" administration factor, in that the tasks here are focused more upon the management of on-going activities and supervision of support personnel (e.g., clerks and technicians). The additional four variables that load on this factor (albeit with lower coefficients) cover a variety of operational tasks and suggest that (1) "second-level" administrators are found in a variety of inquiry and inquiry-related activities and (2) managers at this level often are directly involved in the operations which they manage.

Task factor 12. Task factor 12 is named developing and scoring tests in accord with the following variables which loaded on this factor:

T37	Scaling, norming and establishing reliability and validity of measuring instruments	.809
T45	Scoring tests	.523
T34	Selecting or constructing and revising ability and/or achievement tests	.381

The persons engaged in this group of tasks appear to be test specialists who are principally involved in the development of tests.

Intercorrelations among task factors. Study of the intercorrelations among the twelve factors described above is also informative; such intercorrelations are presented in Table 5. Only three of these correlation coefficients are greater than .2 in absolute value; these three are all positive correlations. The largest of these correlations (.270 between task factors 1 and 4) suggests some association between research and evaluation, which is not surprising. An inspection of the task variables in each of these two factors points to the use of data as the strongest link between them. The next strongest of these correlations (.229 between factors 3 and 11) is between the two administration factors. The third strongest association (.208 between factors 5 and 11) suggests that some of the same persons who are engaged in "second-level" administration activities may also be responsible for the dissemination of information about their project or program.

Task factor frequencies. The frequency with which each *task factor* was performed by the subjects in the sample is reported in Table 6. Each subject who performed one or more of the tasks loading on a given task factor was counted once and only once in the tally on that factor.

TABLE 5

Correlations Among Oblique Task Factors

Factor	1	2	3	4	5	6	7	8	9	10	11	12
1		-142	-032	270	-124	-180	-088	106	-031	-016	002	190
2			135	-002	060	-130	-077	-110	-142	-101	144	134
3				-046	044	-058	157	107	-052	036	229	-160
4					-028	-129	075	-008	-128	-073	-042	178
5						037	-058	-032	038	-080	208	-018
6							-047	002	065	005	-074	004
7								-023	-009	-072	041	-058
8									-055	-019	-035	-051
9										-043	-026	-035
10											-049	-011
11												-017
12												

NOTE: Leading decimal points are omitted.

TABLE 6

Number of Subjects Who Performed One or More Tasks Under Each Task Factor

TASK FACTOR	N PERFORMING TASK(S) UNDER THIS FACTOR
1	98
2	70
3	101
4	85
5	88
6	5
7	22
8	64
9	49
10	76
11	62
12	35

In view of the fact that the maximum frequency possible in Table 6 for any task factor is 116 (the number of subjects in the study), the overall frequencies appear to be relatively high. In addition to the fact that a person was entered in the tally if he was involved in even one task out of the several in each task factor, the high frequencies suggest that many subjects are involved in a variety of diverse tasks. This point is borne out by inspection of the original data and is also consistent with the multiple functions of many of the agencies in which members of the sample were employed.

The two factors with the lowest frequencies and the two factors with the highest frequencies deserve specific study (although not simply because of the extremity of their occurrence). The low frequency (5) for task factor 6 -- developing and operating information storage and retrieval systems -- is apparently due to the fact that the factor includes tasks which were almost exclusively limited to members of one ERIC information retrieval center. The frequency (22) of task factor 7 -- evaluating proposals and monitoring funded projects -- is higher than might be anticipated in view of the type of agencies sampled. However, inspection of the frequencies of each specific task appearing in that factor (tasks 18, 19 and 62) is revealing. Frequencies for each specific task are shown in Table 7. In looking at task 19, it is apparent that only seven persons were involved in the processing of proposals and monitoring of the funded projects -- activities peculiar to agencies which provide some funding support. The other two tasks (T18 and T62) are tasks in which persons in a variety of agencies are often engaged, e.g., through serving on review panels.

At least two factors may contribute to the high frequency (101) for task factor 3 -- "first-level" administration. First, this task factor includes a relatively large number of tasks (9). Second, it may indicate that many persons in R & D organizations enter into "higher-level" decision-making processes at least occasionally during their employment in the type of agencies sampled. Also, the sample was chosen to include a number of administrators at each level, resulting in many persons who would be routinely expected to perform higher-order administrative duties as part of their job. The relatively high frequency (98) for task factor 1 -- designing

TABLE 7

Number of Subjects Who Performed Each of 69 Specific Tasks

TASK	N PERFORMING TASK	TASK	N PERFORMING TASK
T1	41	T36	47
T2	44	T37	11
T3	40	T38	24
T4	17	T39	24
T5	31	T40	3
T6	38	T41	17
T7	47	T42	24
T8	28	T43	24
T9	35	T44	24
T10	19	T45	8
T11	39	T46	43
T12	28	T47	25
T13	31	T48	10
T14	49	T49	44
T15	55	T50	3
T16	25	T51	47
T17	5	T52	11
T18	11	T53	81
T19	7	T54	43
T20	30	T55	7
T21	42	T56	24
T22	26	T57	25
T23	28	T58	35
T24	8	T59	29
T25	37	T60	9
T26	18	T61	23
T27	12	T62	17
T28	24	T63	37
T29	22	T64	2
T30	17	T65	3
T31	8	T66	4
T32	3	T67	3
T33	43	T68	13
T34	31	T69	7
T35	18		

research studies and conducting and interpreting data analyses -- is probably due to the reliance of research, evaluation and product testing (part of development) on analyzing data and interpreting results.

Identification and Interpretation of Competency Factors

The oblique transformation (Harris-Kaiser Independent Clusters solution) of the seven factors obtained from the factor analysis of competency data in package 04 (as described in the previous section) resulted in the factor pattern summarized in Table 8. The factors in this pattern are identified below. For the purpose of factor identification and interpretation, only competencies which possessed pattern coefficients greater than .30 in absolute value were used.

TABLE 8

Factor Pattern for Factor Analysis of Package 04 Competencies (Harris-Kaiser Independent Clusters Oblique Solution)

COMPETENCY	FACTOR						
	1	2	3	4	5	6	7
C102	325	439				210	-105
C105		416			120	160	
C106	-118	574	-102	371		-100	
C107	-131	367				-171	160
C109	154	449		-167	-114		
C115		676					
C116		467				-121	
C202		303	-273		102	262	144
C203	-182	156	-166		234	214	295
C205	501	138	139		207	175	-135
C206	332	363				-121	
C208	363	263	-141		-281		
C209	-156			494	-430	135	
C211	243	206	-108	105	223	-166	328
C218	166		-269	280	-118	133	231
C223	345	152		159	342	-122	
C302	178	249	275		-198	278	-101
C304	314	197	100	230	-120		151
C307		261	109	166	-257	-178	456
C310		154			-160	471	
C312		-140				755	
C363				661			
C371	-146	-256	-121	271	245		352
C374				633	-188		
C404		-151	388	155	142	-147	
C408	413		211		111		-195
C409	-159		514		113		258
C412			520	142			166
C413	-111		424				
C415	-159		158	-208			
C417	-105		433	-136	-323		177
C420			-148		343	-191	285
C501	-209	-159		329	225		176
C502	-125	-295		345	270		293
C541				582	193		
C543		222		584	182		-167
C603						629	

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown. Leading decimal points are omitted.

TABLE 8 (cont'd)

Factor Pattern for Factor Analysis of Package 04 Competencies (Harris-Kaiser Independent Clusters Oblique Solution)

COMPETENCY	FACTOR 1	2	3	4	5	6	7
C604		243				594	
C607	-240	-145		-319		325	
C608			-111		487	261	-164
C609					373	-185	
C10		304		-105	369	108	
C611	-204			-232	282	354	229
C613	-102	547				202	
C614				113	538		183
C616		104			339		-106
C617	-183	110	-100	-112	221	337	251
C620	141		112		449		-168
C622		333	-243	-210	263	-133	-104
C625					356	180	249
C629	-222	432		-144	238	-248	
C729	-236			529			179
C801	388					286	371
C802	282		193		-243	-156	283
C807	530		138	206	-129		
C810			145		-176		542
C811	571					-112	
C812					136		654
C815	488				-145	210	105
C819			109	-131	-118		650
C822	565				141	-212	130
C824	623		-175	-110			-247
C825	466	-158	-285	-137		-103	
C826	691	-214	-147			164	177
C828	149		-182	-315			366
C830	558			-151			
C831	502		-212	-166		-113	292
C832	525	-118	-187				

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown. Leading decimal points are omitted.

TABLE 8 (con't)

Factor Pattern for Factor Analysis of Package 04 Competencies
(Harris-Kaiser Independent Clusters Oblique Solution)

COMPETENCY	FACTOR 1	2	3	4	5	6	7
C911	-103		565		-142		
C912	-170		462	-128			
C916	-217		-188				512
C917	328	-145	228	-119	200		
C001	122	-315			478		
C002	346	-106	179		352		
C004			511	-202	134	115	
C005	292	-250	114		194		-139
C009	196	392	115			-107	
C010		281	149	-147	444	-148	
C013	372		461	119	155	-111	
C015		146	388		193		107
C017	429	-124			193	176	-178
C018					290		-281
VARIANCE OF FACTORS	5.891	4.033	3.371	3.537	3.904	3.133	3.621

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown. Leading decimal points are omitted.

Competency factor 1. The principal loadings on this factor are from the following competencies:

C826	Ability to design card layouts to allow data analysis within computer constraints and ability to use standardized computer programs (e.g., BMD series)	.691
C824	Knowledge of how computers might be used to analyze data	.623
C811	Knowledge of t-tests and critical ratios	.571
C822	Knowledge of alternate methods of presenting statistical data (e.g., charts, graphs, or tables)	.565
C830	Ability to use computer coding	.558
C807	Knowledge of ANOVA or ANCOVA designs and techniques	.531
C832	Ability to read and interpret computer output	.525
C831	Ability to keypunch	.502
C205	Knowledge of questionnaire construction techniques and appropriate uses for questionnaires	.501
C815	Knowledge of factor analysis techniques	.488
C825	Ability to allocate time and money wisely in arranging computer work	.466
C017	Ability to describe, explain, or elaborate in writing	.429
C408	Ability to formulate a rationale to support a particular position or argument	.413
C801	Ability to choose (or design) appropriate statistical techniques for data analysis	.388
C013	Ability to write in an interesting or appealing style	.372

C208	Knowledge of norming procedures	.363
C002	Ability to revise and rewrite	.346
C223	Ability to arrange items in a format which is easy to read	.345
C206	Ability to construct instruments to assess attitudes and other affective variables	.332
C917	General speaking skills	.328
C102	Ability to discuss the advantages of establishing evaluation systems in educational institutions	.325
C304	Knowledge of specific experimental and quasi-experimental research designs	.314

The competencies which possess high pattern coefficients on this factor include skills and knowledge related to analysis of data (C826, C811, C807, C815, C801), computer operations and utilization (C826, C824, C830, C831, C832, C825), instrument development and measurement (C205, C208, C223, C206), and reporting (C822, C017, C013, C002). Therefore, factor 1 is named data collection, processing, analysis and presentation competencies.

A second factor, competency factor 7, also has its principal loadings from variables similar to those on competency factor 1. Variables with principal loadings on factor 7 are shown below:

C812	Knowledge of statistical variance and standard deviation	.654
C819	Knowledge of theoretical assumptions underlying various statistical techniques	.650
C810	Knowledge of statistical regression techniques	.542
C307	Ability to design studies to control extraneous variables	.456

C801	Ability to choose (or design) appropriate statistical techniques for data analysis	.317
C828	Knowledge of capabilities of local computer systems	.366
C371	Ability to draw or compose pictures or illustrations for curriculum materials	.352
C211	Ability to construct items that measure what one sets out to measure	.328

The competencies which possess high pattern coefficients on this factor include skills and knowledge related to analysis of data (C812, C819, C810, C801), computer operation and utilization (C828), instrument development (C211), and research design (C307). The highest loadings and a majority of variables relate to statistics and competency factor 7 is therefore named statistical competencies. Admittedly, there is a large area of overlap between competency factors 1 and 7 (r = .32). The difference seems to be one of emphasis rather than coverage, with loadings on factor 7 clustering primarily on only one of the areas of competency included in factor 1.

Competency factor 2. The principal loadings on this factor are the following:

C115	Ability to incorporate systematic evaluation procedures into plans for developing educational programs	.676
C106	Ability to work with public school, university or state department of education personnel	.574
C613	Ability to identify educational needs that should be addressed by educational systems	.547
C116	Ability to develop techniques for providing evaluative feedback to program or project personnel in time to allow needed modifications to be made during the operation of the program	.467

C109	Ability to help others identify and state their objectives	.449
C102	Ability to discuss the advantages of establishing evaluation systems in educational institutions	.439
C629	Ability to work effectively with decision makers	.432
C105	Knowledge of personnel and the organizational structures of public school systems and universities	.416
C009	Ability to put quantitative or numerical information into verbal or narrative form	.392
C107	Ability to determine the evaluative questions which must be asked in evaluation and the information which must be gathered to answer these questions	.367
C206	Ability to construct instruments to assess attitudes and other affective variables	.363
C622	Ability to facilitate staff work on an ongoing project	.333
C001	Ability to write	-.315
C610	Ability to identify and obtain resources needed to accomplish program objectives	.304
C202	Knowledge of measurement theory and techniques	.303

The competencies which possess high pattern coefficients include specific evaluation competencies (C613, C116, C109 and C107), competencies relating to installing evaluation systems (C115, C102), knowledge of some tools of evaluation (C206, C202), competencies in relating to persons necessary in conducting evaluations (C106, C629), and competencies in translating numerical results into reports (C009). Therefore, competency factor 2 is named evaluation competencies.

Competency factor 3. The highest pattern coefficients on this factor are from the following variables:

C911	Ability to use library research techniques	.565
C412	Ability to predict with accuracy the impact of an inquiry or inquiry-related activity	.520
C409	Ability to evaluate or critique a written or oral presentation	.514
C004	Ability to synthesize or summarize	.511
C912	Ability to use ERIC or other information retrieval systems	.462
C417	Ability to make long-range forecasts or predictions	.432
C413	Ability to conceptualize or "brainstorm" new ideas	.424
C015	Ability to write clearly and/or concisely	.388
C404	Ability to be creative	.388

Four of the variables (C911, C912, C409, C004) deal with ways of acquiring or using information, one deals specifically with evaluating information (C409), two relate to forecasting competencies (C412, C417), and two to developing new ideas (C413, C404). Therefore, competency factor 3 is named *ability to obtain and use information to forecast events or outcomes or develop new ideas*.

Competency factor 4. This factor received its highest loadings from the following variables.

C363	Knowledge of current theories of learning, especially as they relate to theories of instruction	.661
C374	Knowledge of developmental psychology or the field of psychology in general	.633

C543	Knowledge of the role of the teacher including abilities which normally can be expected of teachers	.584
C541	Knowledge of instructional approaches that might be incorporated in teaching or designing instructional materials	.582
C729	Ability to establish rapport with children and obtain their cooperation in testing situations	.529
C209	Knowledge of theory and techniques for assessing student achievement	.494
C502	Knowledge of printing constraints and specifications	.345
C501	Knowledge of steps involved in the mass production of curriculum materials (e.g., reproduction and packaging processes)	.329
C828	Knowledge of capabilities of local computer systems	-.315

The first six of these nine variables, which have positive coefficients of .49 or above, are consistent with naming competency factor 4 knowledge of students, teachers, and educational and psychological processes.

Competency factor 5. The following variables possessed high loadings on this factor:

C614	Ability to determine financial resources necessary to conduct a program or project and use accounting procedures to operate within a program or project budget	.538
C608	Ability to supervise personnel	.487
C001	Ability to write	.478
C620	Ability to outline specific procedures for working through a problem	.449

C010	Ability to write in a style and at a level appropriate to a specified audience	.444
C209	Knowledge of theory and techniques for assessing student achievement	-.430
C609	Knowledge of effective techniques for writing and submitting proposals to obtain funding	.373
C610	Ability to identify and obtain resources needed to accomplish program objectives	.369
C625	Ability to make progress assessments for ongoing activities	.356
C002	Ability to revise and rewrite	.352
C420	Knowledge of legalities related to inquiry or inquiry-related projects	.343
C223	Ability to arrange items in a format which is easy to read	.342
C616	Knowledge of and ability to use management and planning systems such as PERT (Program Evaluation and Review Technique), PPBS (Program Planning Budgeting System), or Critical Path Analysis	.339
C417	Ability to make long-range forecasts or predictions	-.323

Of the 14 competencies loading on this factor, seven (C614, C608, C620, C609, C610, C625 and C616) are specific administrative competencies related to the operation of research and research-related projects or programs. The competency related to legal aspects of conducting such activities (C420) is consistent with competencies related to the production of proposals (C609), formulation of budget-accounting procedures (C614) and the supervision of personnel (C608). Similarly, the three writing competencies which load on this factor (C001, C010, and C002) are not surprising. For example, the ability to write to a given audience (C010) is complementary to competency C609, the presentation and production of proposals to obtain funding. Competency C002--an editing competency--is often employed by senior researchers or project directors. It is not readily apparent why competency C223, which is concerned with the technical aspects of the form of a test or other type of measuring instrument, loads positively on this factor. Competencies C209 and C417, which both load negatively, are not of an administrative nature. Consequently, factor 5 will be named operational administrative competencies.

Competency factor 6. The following variables have the principle loadings on this factor.

C312	Ability to plan effective development procedures	.755
C603	Knowledge of inquiry or inquiry-related management	.629
C604	Knowledge of the role of inquiry and inquiry-related activities in education	.594
C310	Knowledge of methods for planning or installing a complete curriculum or a curriculum package	.471
C611	Knowledge of personnel evaluation practices	.354
C617	Knowledge of effective techniques of recruiting, interviewing, and hiring personnel	.337
C607	Knowledge of the organization for which you are working, including knowledge of its needs, resources, methods of operation, etc.	.325

The competencies described above are needed by persons in policy making and higher level administrative positions. Two competencies deal specifically with planning (C312 and C310), one (C603) with project or program management, two (C604 and C607) with knowledge of the employing organization or the roles played by persons within it, and two (C611 and C617) with the employment and evaluation of personnel. Competency factor 5 and competency factor 6 are both related to administration, with the difference being one of levels of functioning. Factor 6 includes competencies related to policy and decision making on projects and programs related to educational inquiry. In contrast, the competencies which possess high loadings on factor 5 are related more to the actual operation of such projects or programs. In accord with this distinction, competency factor 6 will be named policy making and decision making competencies.

Competency factor 7 was previously named statistical competencies. Because of its close relationship to competency factor 1, this factor and variables having principle loadings on it were discussed earlier along with competency factor 1.

Intercorrelations among competency factors. The intercorrelations among the seven competency factors are shown in Table 9. The two correlations greater than .15 in absolute value are both understandable in view of the nature of the relevant factors. The highest correlation, that of .318 between factors 1 and 7, is reasonable in that both factors are related to data analysis or data analysis tools. The correlation between factors 5 and 6 (.162) is reasonable in that both are administrative factors. The fact that the correlation is low suggests that the same person uses both operational and policy-making administrative competencies only on a small subset of projects or programs.

Table 9

Correlations Among Oblique Competency Factors: Package 04

Factor	1	2	3	4	5	6	7
1		139	-018	-010	-113	-043	318
2			-093	-007	001	108	-064
3				-110	136	-049	-008
4					-039	-023	042
5						162	-008
6							-017
7							

Note: Leading decimal points are omitted.

Additional competencies added to each competency factor. Upon completion of the factor analysis of package 04, the combination of empirical and logical procedures described in the previous section on data analysis procedures was used to add additional competencies to those contained in the original seven factors. In each case, the variables added by the empirical-logical procedure were consistent with the identification and interpretation of each factor that resulted from the factor analysis of package 04. Table 10 contains a final listing of the competencies included under each of the competency factors. The competencies determined by the factor analysis of package 04 are listed first, above the solid line in each column. The competencies added through the empirical-logical procedure are listed below the solid line in each column, with those added based on logical grounds only included in parentheses.

Table 10

Summary of Placement of Competencies Within Competency Factors

Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
C102	C102	C404	C209	C209	C310	C211
C205	C105	C409	C363	C223	C312	C307
C206	C106	C412	C374	C417	C603	C371
C208	C107	C413	C501	C420	C604	C801
C223	C109	C417	C502	C608	C607	C810
C304	C115	C911	C541	C609	C611	C812
C408	C116	C912	C543	C610	C617	C819
C801	C202	C004	C729	C614	C112	C828
C807	C206	C015	C828	C616	C606	C201
C811	C610	C101	C361	C620	C614	C304
C815	C613	C217	C366	C625	C906	C305
C822	C622	C313	C368	C001	C601	C306
C824	C629	C405	C373	C002	C602	C366
C825	C001	C406	C375	C010		C804
C826	C009	C407	C376	C210		C808
C830	C103	C408	C401	C414		C823
C831	C104	C415	C402	C630		C827
C832	C108	C416	C411	C902		C834
C917	C110	C615	C421	C905		C308
C002	C111	C618	C506	C915		(C204)
C013	C113	C904	C507	C018		(C215)
C017	C114	C906	C508	C628		(C221)
C301	C118	C915	C545	C615		C309
C302	C119	C401	C701	C627		C314
C303	C203	C903	C702	C601		C808
C701	C207	C001	C914	C602		C821
C802	C378	C005	C904	C619		(C011)
C806	C628	C014	C210	C621		
C804	C726	C003	C905	C623		
C805	C803	C006	C204	C624		

Table 10, continued

Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
C808	C804	C411	C215	C626		
C814	C805	C907	C308			
C816	C813	C908	C364			
C817	C904	C018	C403			
C903	C003	C418	C504			
C918	C006	(C623)	C505			
C919	C630	C913	C548			
C001	C112	C016	(C619)			
C005	C212		(C621)			
C014	C012		(C624)			
C015	C204		(C626)			
C212	C215		(C727)			
C305	C221		C728			
C112	C308		C821			
C204	C309		C901			
C215	C314		C918			
C221	C403		C011			
C308	C623		C016			
C309	(C624)					
C314	(C626)					
(C403)	C727					
C808	C728					
C821	C821					
C901	C901					
C011	C918					

NOTE: The competencies determined by the factor analysis of package 04 are listed first, above the solid line in each column. The competencies added through the empirical-logical procedure are listed below the solid line in each column. Competencies placed in the competency factors on purely logical grounds are enclosed by parentheses.

This listing represents seven groups of competencies that tend to be held in common by certain individuals who are engaged in exemplary research and research-related work. Thus, the analysis has identified seven "types" of individuals in terms of the competencies they possess. In the next section the relationship between these competency factors and the 12 task factors will be explored.

Relationships Between Competency Factors and Task Factors

The two stage empirical process described in the previous section on the results of the data analysis was used to pair the competency factors and task factors. The data used in this process were the frequency of occurrence of competencies within task factors presented in Table 11. The first stage in the process resulted in eighteen competency factor-task factor pairings, with two additional pairings added as the result of the second stage. The results are listed in Table 12 and discussed under each task factor below.[14] Each task factor will also be considered as defining a broad inquiry or inquiry-related function in the discussions in the remainder of this paper.[15]

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[14] One qualification needs to be made concerning these relationships. Competencies required for the performance of each task factor are not necessarily limited to those contained in the competency factors paired with the task factor here. Although the most widely used competencies were identified in the factor analysis, inspection of the frequency of occurrence of each competency within each task factor (Table 11) shows that many additional competencies are used, albeit not frequently.

[15] See definition of "function" given earlier in this chapter.

TABLE 11

Frequency of Competencies Within Each Task Factor

COMPE-TENCY	TASK FACTOR 1	2	3	4	5	6	7	8	9	10	11	12
C101	1	1	2	1	3	0	0	1	1	1	1	6
C102	3	6	7	19	5	0	2	0	3	5	2	2
C103	20	16	36	35	23	1	8	6	5	13	12	3
C104	4	5	14	8	4	0	2	3	2	0	2	3
C105	10	12	17	23	7	0	3	6	3	6	5	0
C106	6	15	12	23	2	0	2	1	1	6	5	1
C107	2	0	2	7	1	0	1	2	0	1	0	0
C108	2	8	9	20	2	0	6	0	0	2	5	1
C109	3	5	9	17	1	0	2	0	2	4	0	0
C110	9	8	7	27	2	0	4	2	2	3	1	1
C111	3	2	3	10	4	0	2	3	0	2	0	0
C112	12	5	5	17	1	0	2	1	1	4	3	1
C113	0	3	6	4	2	0	2	1	1	0	1	1
C114	5	1	3	4	0	1	3	0	0	2	0	9
C115	1	2	2	9	0	0	0	0	0	1	0	3
C116	2	2	0	3	0	0	0	0	0	0	0	2
C117	0	1	1	1	0	0	0	0	1	0	0	0
C118	0	2	4	6	0	0	0	0	0	2	1	1
C119	0	1	2	3	2	0	0	0	0	1	0	1
C201	5	2	1	8	0	0	0	1	0	0	1	0
C202	11	8	10	22	1	0	2	0	3	8	3	3
C203	2	4	1	1	0	0	0	0	1	2	1	1
C204	12	4	4	19	1	0	0	1	0	3	1	7
C205	2	3	5	16	2	0	0	0	0	3	1	0
C206	1	2	1	11	0	0	1	0	0	1	0	0
C207	10	5	4	15	0	0	0	1	2	5	0	2
C208	6	2	1	3	0	0	0	0	0	3	0	0
C209	3	7	2	2	1	0	0	1	0	1	1	2
C210	3	6	4	3	2	0	0	0	0	0	1	1
C211	2	1	0	17	0	0	0	0	0	0	0	2
C212	0	0	0	13	0	0	0	0	0	0	0	1
C213	1	0	0	5	0	0	0	0	0	0	0	0
C214	0	0	0	0	0	0	0	0	0	0	0	1
C215	1	0	1	6	0	0	0	0	0	1	0	2
C216	0	0	0	4	0	0	0	0	0	0	0	0
C217	1	0	0	11	0	0	0	0	0	0	1	0
C218	11	2	1	4	1	0	0	1	0	5	0	4
C219	0	0	0	2	0	0	0	0	0	2	1	1

TABLE 11 (cont'd)

Frequency of Competencies Within Each Task Factor

COMPE-TENCY	TASK FACTOR 1	2	3	4	5	6	7	8	9	10	11	12
C220	1	0	0	2	0	0	0	0	0	1	0	0
C221	2	1	2	12	1	0	1	1	2	1	1	2
C222	0	1	0	0	0	0	0	0	0	0	0	0
C223	0	3	0	8	4	0	0	0	0	1	0	2
C301	9	2	3	6	2	1	2	4	2	9	3	1
C302	5	2	5	9	2	0	0	0	3	5	1	0
C303	11	2	6	10	2	0	2	4	1	9	1	1
C304	24	4	4	9	1	0	0	1	7	19	2	2
C305	17	3	6	11	1	0	0	3	3	13	3	2
C306	19	10	18	12	0	1	2	1	5	15	4	1
C307	12	0	3	14	1	0	0	1	3	10	1	0
C308	14	5	3	12	2	0	0	6	1	9	5	1
C309	22	3	6	21	1	0	0	3	2	17	2	2
C310	0	3	2	2	0	0	0	0	0	1	0	0
C311	1	1	1	4	0	0	0	0	0	1	0	0
C312	0	6	6	0	0	0	0	0	1	0	0	0
C313	6	2	8	6	1	1	1	2	2	2	0	1
C314	15	1	2	11	6	1	1	1	0	4	0	1
C361	4	11	10	6	3	1	0	6	2	2	1	0
C362	0	4	4	1	3	0	0	0	0	0	1	1
C363	7	12	11	6	2	0	0	5	1	5	2	1
C364	2	3	3	3	2	0	1	1	1	1	1	0
C365	2	2	2	2	3	1	0	1	0	1	2	0
C366	1	8	2	3	0	0	0	1	0	0	3	0
C367	0	1	1	0	0	0	0	0	0	0	0	0
C368	1	13	7	7	1	0	2	0	1	2	4	0
C369	2	1	2	1	0	0	0	0	0	0	0	0
C370	0	1	0	0	0	0	0	0	0	1	2	0
C371	1	5	0	2	8	0	0	0	0	2	3	2
C372	0	5	1	0	0	0	0	0	0	0	0	0
C373	4	2	1	3	0	0	0	0	0	3	0	0
C374	13	12	10	9	4	0	1	8	0	7	8	2
C375	0	4	2	1	0	0	0	2	1	0	0	0
C376	4	16	11	4	2	0	0	4	1	0	1	0
C377	0	0	0	0	3	0	0	0	0	0	0	2
C378	0	1	2	4	4	0	0	0	0	0	1	2
C401	31	24	38	24	25	5	3	28	9	19	11	6
C402	4	11	12	3	4	0	1	7	0	2	1	1

TABLE 11 (cont'd)

Frequency of Competencies Within Each Task Factor

COMPE-TENCY	TASK FACTOR 1	2	3	4	5	6	7	8	9	10	11	12
C403	1	3	1	2	1	0	0	1	0	0	1	1
C404	2	3	2	0	5	0	0	1	2	2	1	1
C405	18	13	20	12	18	3	2	11	7	4	4	2
C406	10	1	1	1	5	0	0	8	0	6	0	0
C407	11	7	12	6	7	1	0	6	3	5	2	4
C408	2	2	2	4	4	1	1	3	4	1	2	0
C409	20	21	23	22	16	5	9	29	4	11	10	2
C410	1	0	1	0	1	0	0	0	0	0	0	0
C411	6	8	8	4	3	1	0	4	2	4	0	0
C412	1	0	5	2	2	0	0	0	2	0	0	1
C413	7	5	13	3	10	1	0	5	4	1	2	0
C414	0	3	7	1	1	0	0	0	2	0	2	0
C415	2	1	3	1	2	1	0	2	2	0	0	0
C416	3	3	7	1	5	0	0	3	1	1	0	1
C417	4	2	1	0	7	0	0	3	0	2	1	8
C418	4	3	5	4	3	0	0	2	1	1	0	1
C419	1	0	0	0	2	0	0	2	0	0	0	7
C420	1	2	3	4	0	1	0	1	0	1	0	2
C421	11	25	21	28	7	0	3	1	5	9	8	3
C422	0	2	1	0	1	1	0	1	1	0	1	6
C501	1	2	4	0	5	0	0	1	1	0	5	4
C502	0	2	1	0	11	1	0	0	0	1	3	2
C503	0	1	0	0	1	0	0	0	0	3	0	0
C504	0	0	4	0	1	0	0	0	0	1	3	0
C505	0	2	1	0	4	0	0	0	0	0	2	1
C506	0	3	0	0	1	0	0	0	0	0	3	1
C507	0	10	0	2	1	0	0	0	0	1	10	0
C508	0	5	3	0	2	0	0	0	0	0	3	4
C509	0	0	0	0	0	0	0	0	0	0	2	0
C541	5	17	8	9	5	1	1	3	1	1	5	4
C542	2	4	3	6	0	0	0	0	1	1	0	0
C543	5	18	17	16	5	1	1	4	0	0	8	3
C544	0	0	1	3	0	0	0	0	0	0	0	0
C545	7	13	16	14	7	1	2	3	0	4	6	0
C546	0	0	0	1	0	0	0	0	0	0	0	1
C547	2	2	1	6	0	1	1	2	0	1	0	2
C548	0	3	2	2	0	0	0	0	0	0	1	1
C549	0	2	0	0	0	0	0	0	0	0	2	2

TABLE 11 (cont'd)

Frequency of Competencies Within Each Task Factor

COMPE-TENCY	TASK FACTOR 1	2	3	4	5	6	7	8	9	10	11	12
C601	5	5	20	7	6	0	1	1	4	5	5	2
C602	3	3	10	1	3	0	0	2	1	1	0	0
C603	1	3	7	0	0	0	0	2	3	0	0	3
C604	1	3	8	4	2	0	0	2	0	1	0	4
C605	0	0	3	1	1	0	0	0	0	0	1	0
C606	2	10	22	5	5	0	2	1	0	2	5	0
C607	4	6	17	5	9	2	1	2	2	3	10	0
C608	10	12	54	16	7	1	4	6	4	4	24	2
C609	1	2	4	0	2	0	1	1	9	2	0	0
C610	3	10	22	10	3	0	1	0	4	3	2	0
C611	1	0	9	0	1	0	1	0	0	0	11	0
C612	0	0	1	0	0	0	0	0	0	0	0	2
C613	8	11	16	17	3	1	0	0	3	4	5	1
C614	2	8	24	5	3	0	1	1	9	1	2	1
C615	10	15	44	14	13	0	4	2	6	8	12	0
C616	1	3	12	4	1	0	0	1	0	0	2	0
C617	1	0	7	2	0	0	0	0	0	0	7	0
C618	3	3	3	2	2	0	1	5	0	0	2	0
C619	1	5	3	1	1	0	1	1	0	0	4	0
C620	4	5	17	5	3	0	1	1	6	2	6	1
C621	0	8	8	2	1	0	1	1	2	2	4	1
C622	0	2	8	6	0	0	3	0	0	0	1	0
C623	4	6	13	12	7	0	0	1	7	3	5	1
C624	1	4	13	6	7	0	3	4	1	1	6	2
C625	8	8	16	8	2	0	3	0	1	5	6	1
C626	1	1	9	3	2	0	1	0	3	0	2	0
C627	1	1	7	4	2	0	0	1	1	1	2	0
C628	4	7	18	15	9	1	3	1	1	3	5	0
C629	0	1	10	5	2	0	0	0	1	1	2	0
C630	1	2	2	2	2	0	0	0	3	1	0	0
C701	2	1	3	4	0	0	1	2	1	2	8	4
C702	1	3	4	6	2	0	5	1	0	2	11	1
C703	1	0	0	3	0	0	0	1	0	0	2	0
C726	2	1	1	4	1	0	0	0	0	3	0	2
C727	0	0	0	2	2	0	0	0	0	1	0	2
C728	1	1	0	6	0	0	1	0	0	3	2	1
C729	2	5	1	4	1	0	0	1	0	3	0	1
C801	29	2	8	12	5	0	2	3	1	15	0	1

TABLE 11 (cont'd)

Frequency of Competencies Within Each Task Factor

COMPE-TENCY	TASK FACTOR											
	1	2	3	4	5	6	7	8	9	10	11	12
C802	11	0	1	2	1	0	0	2	0	6	0	0
C803	10	10	16	8	6	2	2	4	3	4	4	1
C804	22	0	3	9	2	1	2	8	3	13	2	0
C805	20	3	8	7	4	0	0	4	0	11	1	2
C806	9	0	1	4	2	0	1	0	1	5	3	3
C807	25	1	2	5	1	0	1	1	1	12	0	2
C808	20	2	3	6	2	0	0	2	0	10	0	4
C809	3	0	0	2	0	0	0	0	0	0	0	0
C810	12	1	1	3	0	0	0	1	0	3	0	2
C811	11	1	1	3	1	0	1	1	0	3	0	1
C812	4	1	2	1	0	0	0	2	0	2	0	1
C813	14	2	3	11	1	0	0	1	1	6	2	6
C814	11	2	3	11	0	0	0	1	1	5	0	4
C815	12	0	0	3	0	0	1	0	0	3	0	3
C816	14	0	2	1	0	0	1	1	0	5	0	1
C817	12	0	0	4	0	0	1	1	1	4	0	1
C818	1	0	0	1	0	0	0	0	0	0	0	0
C819	14	2	6	2	6	0	0	1	6	3	0	2
C820	1	0	0	0	0	0	0	0	0	1	0	1
C821	25	2	8	8	4	0	0	5	2	20	2	2
C822	22	0	8	6	9	0	1	1	1	8	2	1
C823	7	1	7	6	7	3	0	5	1	1	0	0
C824	20	1	5	5	0	1	0	0	0	3	1	2
C825	7	0	2	0	0	0	0	0	0	0	0	0
C826	25	1	3	4	0	0	0	0	1	5	2	5
C827	19	4	6	4	1	0	0	0	9	5	4	1
C828	10	2	2	2	0	0	0	0	9	1	3	3
C829	0	0	0	0	0	0	0	1	0	0	0	0
C830	14	0	3	2	0	0	0	0	1	0	1	2
C831	17	0	1	1	0	0	1	0	1	1	2	1
C832	12	0	0	2	0	0	0	1	3	6	1	2
C833	1	1	1	0	0	0	0	1	1	1	0	0
C834	1	2	2	4	2	0	1	0	0	1	0	1
C835	3	0	0	1	0	0	0	0	2	0	0	0
C836	0	0	0	0	0	0	0	0	0	0	0	1
C901	5	1	4	2	1	1	0	2	0	1	1	1
C902	8	8	20	19	9	0	4	1	4	6	2	1
C903	1	1	1	1	1	0	0	0	0	0	1	0

TABLE 11 (cont'd)

Frequency of Competencies Within Each Task Factor

COMPE-TENCY	TASK FACTOR 1	2	3	4	5	6	7	8	9	10	11	12
C904	6	1	8	8	2	0	2	4	5	2	1	0
C905	24	11	16	12	7	0	4	0	5	6	6	4
C906	0	0	4	1	1	0	0	0	0	1	1	0
C907	2	1	1	2	3	0	0	4	2	1	1	2
C908	1	2	3	1	3	0	0	9	1	0	2	1
C909	0	0	0	0	1	0	0	1	1	0	0	1
C910	1	0	2	1	1	0	0	0	0	0	0	0
C911	4	6	9	2	3	3	0	32	1	1	3	0
C912	4	0	3	1	5	4	0	18	1	1	2	0
C913	0	0	1	0	1	1	0	6	0	0	0	0
C914	5	9	4	10	7	1	0	1	0	1	7	0
C915	1	2	4	2	2	0	3	2	2	0	1	0
C916	0	0	0	0	0	0	0	1	0	1	0	0
C917	2	1	4	5	26	0	0	0	0	2	1	0
C918	1	1	4	7	19	0	1	0	0	2	0	1
C919	0	2	2	3	9	0	0	0	0	0	1	1
C920	0	0	1	3	2	0	0	0	0	0	0	0
C001	6	14	8	3	13	1	0	5	8	6	8	0
C002	5	8	4	6	5	2	1	3	4	3	2	2
C003	2	5	5	2	10	4	0	4	3	2	2	2
C004	12	4	14	6	14	3	2	14	3	6	3	0
C005	0	2	1	0	1	1	0	0	0	0	0	0
C006	2	0	4	4	2	0	0	0	2	0	1	1
C007	0	1	0	0	2	0	0	0	0	0	0	1
C008	0	0	0	0	0	0	0	1	0	0	0	1
C009	5	0	2	4	2	0	2	1	0	5	0	0
C010	3	13	15	9	21	1	1	4	5	4	1	1
C011	0	0	0	1	1	3	0	1	0	0	0	1
C012	3	7	5	3	7	0	0	4	1	3	1	0
C013	0	1	0	1	5	0	0	1	1	0	1	0
C014	11	7	12	12	20	1	0	9	9	4	7	1
C015	9	15	10	7	15	2	0	7	9	3	4	0
C016	3	2	8	4	2	1	1	2	4	1	0	0
C017	2	4	4	5	9	0	0	0	5	1	3	0
C018	0	1	7	2	3	0	2	0	15	3	1	1
C019	1	1	2	1	2	0	0	0	1	0	1	0

Table 12

Competency Factor - Task Factor Pairings

Task Factors	Competency Factors
1	1, 7[a]
2	2, 4, 5
3	2, 5, 6[a]
4	2
5	1, 3
6	3
7	2, 5
8	3
9	5
10	
11	5, 6
12	4

[a] This competency factor is one of two identified by the second stage of the identification process described in the section on data analysis procedures.

Task factor 1. Designing research studies and conducting and interpreting data analyses. The competency factors related to this task factor are No.1, data collection, processing, analysis, and presentation competencies and No.7, statistical competencies. A review of the competencies that make up these two competency factors indicates that persons involved in this function (task factor) use skills of data processing, data analysis, information presentation and instrument construction, and knowledge of statistics, experimental controls and computer capabilities.

Task factor 2. Developing instructional materials. The competency factors related to this task factor are No. 2, evaluation competencies; No. 4, knowledge of students, teachers, and educational and psychological processes; and No. 5, operational administrative skills. A review of the competencies which form these three competency factors shows that the competencies are logically related to the function of developing instructional materials. Evaluation skills are obviously relevant to the field and product testing aspects of development. Knowledge about students, teachers, learning theories, and educational processes is obviously necessary to the person developing instructional materials. Skills in administering a project and supervising work of other persons are also relevant since development seems typically to be a team activity requiring coordinated efforts of many persons.

Task factor 3. "First-level" administration of inquiry and inquiry-related projects and activities. Competency factors No. 2, evaluation competencies; No. 5, operational administrative skills; and No. 6, policy making and decision making competencies are related to this task factor. Study of these competency factors shows the inclusion of the obviously relevant clusters of administrative competencies such as budgeting, personnel supervision, specification of work tasks and procedures, resource allocation, personnel hiring and evaluation, and management planning systems such as PERT. It is not surprising that evaluation competencies are included in view of their contribution to administration through providing information to support decision making.

Task factor 4. Conducting evaluations and constructing and using data collection instruments. Competency factor No. 2, evaluation competencies, is related to this function, which would be expected in view of the similar nature of the competency and task variables. Included in this competency factor are competencies such as planning evaluations, specifying objectives, constructing attitude scales, putting numerical information in written form, and knowledge of evaluation and measurement.

Task factor 5. Diffusing information and products. Competency factors No. 1, data collection, processing, analysis, and presentation competencies, and No. 3, ability to obtain and use information to forecast events or outcomes or develop new ideas are related to this task factor. The latter competency factor emphasizes dissemination skills such as using library search processes, writing clearly and concisely, and summarizing and synthesizing ideas. The most relevant skills on the first competency factor are presentation competencies, such as presentation of data, describing or elaborating in writing, and putting numerical information into verbal form.

Task factor 6. Developing and operating information storage and retrieval systems. Competency factor No. 3, ability to obtain and use information to forecast events or outcomes or develop new ideas, is related to this task factor. This competency factor includes library search skills, the ability to critique written presentations, the ability to summarize and synthesize, knowledge of and ability to use information retrieval systems, and the ability to write clearly and concisely. All these competencies are clearly relevant.

Task factor 7. Evaluating inquiry and inquiry-related proposals and monitoring funded projects. Two competency factors related to this task factor are No. 2, evaluation competencies, and No. 5, operational administrative skills. Many evaluation competencies obviously come into play in evaluating proposals. Administrative competencies useful in monitoring funded projects include ability to make progress assessments for ongoing activities, knowledge of legalities related to project management, and knowledge and ability to use management systems such as PERT.

Task factor 8. Searching, reading, and reviewing the literature. Competency factor No. 3, ability to obtain and use information to forecast events or outcomes or develop new ideas, is related to this task factor. Several competencies on competency factor 3 which are logically related to the process of obtaining information from the literature include the following: ability to use library research techniques, ability to critique written presentations, ability to summarize or synthesize, and ability to use information retrieval systems.

Task factor 9. Designing and maintaining computer systems and writing computer programs. Competency factor No. 5, operational administrative skills, is related to this task factor. Skills in budgeting, personnel supervision, work task and procedures specification, resource allocation, writing, and knowledge of proposal preparation are included on competency factor 5. It is not unexpected that these administrative skills are employed in designing computer systems.

Task factor 10. Unnamed. Because tasks within this factor did not appear logically connected in any way, no attempt was made to place competency factors with task factor 10.

Task factor 11. "Second-level" administration of inquiry and inquiry-related projects and activities. Competency factors related to this function are No. 5, operational administrative skills, and No. 6, policy making and decision making competencies. Both the task factor and the two competency factors are clearly focused upon administration. Among the administrative competencies listed under these factors are skill in project budgeting; personnel supervision; specification of work tasks and procedures; resource allocation; recruiting, hiring and evaluating personnel; making progress assessment of ongoing activities; ability to make long-range forecasts; knowledge of project or program management; knowledge of role of inquiry and inquiry-related activities in education; and knowledge of management and planning systems such as PERT.

Task factor 12. Developing and scoring tests. Competency factor No. 4, knowledge of students, teachers, and educational and psychological processes, is related to this task factor. Knowledge of learning theories and developmental psychology, knowledge of teacher roles, knowledge of instructional approaches, knowledge of theory and techniques for assessing student achievement, and ability to obtain cooperation of students in testing situations are obviously competencies which are relevant to this task factor.

Relationships Between RDDE and Inquiry and Inquiry-related Functions Identified Through These Data

The basic objective of this study was to identify the functions, tasks and competencies required in exemplary educational research and research-related activities. The results of the data analysis reported in previous sections of this chapter have identified clearly tasks and competencies required in such activities. The eleven interpretable task factors also identify eleven broad functions (groups of tasks) which are performed by inquiry and inquiry-related personnel in the field of education. A discussion of these functions and their relationship to the commonly used rubrics of research, development, diffusion, and evaluation is contained in this section.

A "function" was defined for this study as a "broad range of activities or tasks which taken together lead to the attainment of a particular inquiry goal." Examples of functions were listed as research, development, diffusion, and evaluation (RDDE)--four activities which, on a priori grounds, have been thought of as collectively comprising the spectrum of inquiry and inquiry-related activities in education. It was the intent in this study to ignore the RDDE rubrics and let the data analysis suggest functions which could be defended on empirical grounds. However, it was also the intent to try to relate functions identified through the data analysis with the more commonly used categories of RDDE. The attempt to draw such relationships appears below, in Table 13.

TABLE 13

Interpretation of Relationships Between Task Factors and Research, Development, Diffusion, and Evaluation

	Task Factor	Is thought to be related to Research (R), Development (De), Diffusion (Di), or Evaluation (E)
1	Designing research studies and conducting and interpreting data analyses	R (E)
2	Developing instructional materials	De
3	"First-level" administration of inquiry and inquiry-related projects and activities	
4	Conducting evaluations and constructing and using data collection instruments	E (R)
5	Diffusing information and products	Di
6	Developing and operating information storage and retrieval systems	(Di)
7	Evaluating inquiry and inquiry-related proposals and monitoring funded projects	(E)
8	Searching, reading, and reviewing the literature	(R)
9	Designing and maintaining computer systems and writing computer programs	
10	Unnamed	
11	"Second-level" administration of inquiry and inquiry-related projects and activities	
12	Developing and scoring tests	

NOTE: Parenthetical entries in the column at the right denote secondary emphasis.

The relationships between the categories of RDDE and the 12 functions (task factors) presented in Table 13 are viewed as tentative; the relationships are not data-based but rely instead on logical interrelationships which seem defensible. Others may find compelling arguments for proposing different interrelationships. Such efforts seem appropriate since the intent here is to suggest probable relationships rather than to argue that all defensible relationships have been included. With this proviso, the relationships shown in Table 13 are discussed briefly below.

The function of designing research studies and conducting and interpreting data analyses (task factor 1) is clearly a part of research as we have commonly used the term. In addition, evaluation is dependent upon data analysis and interpretation and therefore overlaps part of this function as well. Although data may be analyzed and interpreted as part of a development or diffusion effort, it does not follow that this function is therefore development or diffusion. In development, data analysis and interpretation would normally occur only during product testing or field testing activities, which are clearly evaluation by another name. In diffusion, data analysis and interpretation might take place in activities such as market analysis; however, this is simply research, used in this instance to provide information for use by diffusers.[16]

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[16] RDDE can each be applied to one another. For example, one can do research on diffusion, development, or evaluation processes. One can evaluate research, development, or diffusion efforts. Results of research, evaluation, and development can all be diffused. Instructional materials can be developed to teach research, evaluation, or diffusion. However, such interrelationships seem to the authors to be conceptually sterile and are not included in the emphases shown in Table 13.

The function of developing instructional materials (task factor 2) obviously includes most of what has been referred to as development in the commonly used rubric of RDDE and requires little comment here. The fact that other development efforts (e.g., the development of organizational or staffing plans) is not included is probably a simple reflection of the fact that development of instructional materials currently occupies most of the attention of the relatively small cadre of educational developers.

The administrative functions (task factors 3 and 11) cut across all four categories of RDDE; administration at both levels is required in projects or programs of all four types. However, administering a research project is not viewed here as research per se, but as a function which facilitates research; parallel reasoning applies to the administration of DDE activities. Therefore, administration is viewed here as an activity that is neither RDD nor E but is requisite for successful accomplishment of any such activities.

The function of conducting evaluations and using data collection instruments (task factor 4) is clearly the E of RDDE. In addition, data collection instruments are essential in research activities and research is therefore viewed as overlapping partially with this function. As with task factor 1, this function may be useful in development or diffusion efforts, but only to the extent that evaluation or research is a necessary part of such efforts.

Diffusing information and products (task factor 5) is clearly the same function that has been described in the literature as diffusion. It should be noted, however, that the activities which compose this function are for the most part dissemination activities and do not include other activities such as demonstration or adoption which are typically viewed as part of the diffusion process (e.g., discussions of diffusion by Clark and Guba[17]). It may be that diffusion does include such activities and the data analyzed here are inaccurate because the agencies and individuals interviewed are not engaged in the full range of diffusion activities which would have been found had other agencies or individuals been selected. Conversely, it may be that the data reflect reality and activities such as demonstration and adoption are important and viable only in the minds of academicians and not in the real world of diffusion. The data presented herein do not allow resolution of this question.

Developing and operating information storage and retrieval systems (task factor 6) is viewed as one type of diffusion. It is clearly not research, evaluation, or development, although it may be useful in any of these activities. The necessary activity of searching out information for input into such systems may be a type of research; however, such activities are subsumed under task factor 8, searching, reading, and reviewing the literature. This function (task factor 8) may also be useful in development, diffusion, or evaluation, but it seems reasonable to interpret it as a type of research function used in these activities rather than DD or E per se.

Although there is an element of evaluation in task factor 7, evaluating inquiry and inquiry-related proposals and monitoring funded projects, this should not obscure the fact that this is largely a function of personnel in funding agencies or persons temporarily helping funding agencies reach evaluative judgments and is not a routine function of the professional evaluator.

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[17] Clark, D. L. and Guba, E. G. An examination of potential change roles in education. Paper presented at a Seminar on Innovation in Planning School Curricula at Aerliehouse, Virginia, Oct.2 - 4, 1965.

Designing and maintaining computer systems and writing computer programs (task factor 9) seems a function related to but independent of RDDE. It is used most frequently in R and E but is not in and of itself research or evaluation, even though it serves as a tool in both. The same logic applies to task factor 12, developing and scoring tests. This function is critical to much research and evaluation in that tests are among the most common data collection instruments; however, this does not make measurement research or evaluation.

The attempts to relate the 12 functions (task factors) to RDDE should not be interpreted as meaning that RDDE are viewed as preferable (or even valid) categories of inquiry and inquiry-related activities. The 11 interpretable task factors are proposed here as more meaningful categories for use by persons concerned with training inquiry and inquiry-related personnel. The attempt to relate these functions to RDDE is merely an attempt to assist persons who are more familiar with that rubric to interpret or use the results of this study.

Summary

Data obtained in interviews with persons engaged in exemplary educational research and research-related work were categorized into 69 task categories and 226 categories of competencies employed in performing these tasks. Inter-judge reliabilities of transfer of interview data to written records and categorization of these data were computed. Factor analysis was used to isolate 12 task factors or functions. Factor analysis and additional empirical-logical procedures were used to identify seven competency factors. Relationships between task factors and competency factors were identified. Interpretations of these factors and relationships between the task factors and the commonly used categories of RDDE are discussed.

It is recommended that the functions, tasks, competencies and their interrelationships identified in this study be viewed as tentative and in need of validation. Limitations, such as the size of the sample (116), when viewed in the light of the wide range of tasks and competencies identified, must be considered. Should further validations be conducted, the pilot work reported herein should provide a basis for the development of data collection procedures that can be focused on precise functions, tasks and competencies and thus collect more data about each than was possible in this attempt to depict the domain.

CHAPTER III

DEVELOPMENT OF A SELF-REPORT INSTRUMENT FOR SELECTED SKILLS AND KNOWLEDGE IN EDUCATIONAL RESEARCH, DEVELOPMENT, DIFFUSION, AND EVALUATION

DEVELOPMENT OF A SELF-REPORT INSTRUMENT FOR SELECTED SKILLS AND KNOWLEDGE IN EDUCATIONAL RESEARCH, DEVELOPMENT, DIFFUSION, AND EVALUATION

There is a need for satisfactory instruments designed to assess the competence level of educational research and research-related personnel. Such measures are needed to enable both research-training and research-producing agencies to assess competencies and deficiencies of trainees and employees as a basis for planning future pre-service or in-service training programs. In recognition of this need, the current Task Force project included two objectives relating to the development of relevant multi-dimensional competence instruments and assessment procedures. One objective (Objective 2.1) related to the development of mastery tests of certain competencies in educational research, development, diffusion, and evaluation (RDDE); the development of these tests is reported in the next chapter of this report. The second related objective (2.2) was stated as follows:

> To design and develop questionnaires to assess RDDE students' and workers' perceptions of their existing competencies and training needs.

The development of these measures was undertaken for four major reasons: (1) the development of pilot tests in Objective 2.1 was viewed as preliminary, requiring extensive and lengthy tryout and norming of the tests before they could be used and interpreted confidently; therefore, the questionnaires were viewed as valuable interim measures;

(2) self-report questionnaires could be used in a variety of situations where administration of mastery tests might not be possible; (3) questionnaires could be used more readily than mastery tests to probe areas where trainees or employees perceived a need for additional training; and (4) it was demonstrated in earlier work of the Task Force (Technical Paper No. 19) that self-reports of competence in RDDE were reliable and apparently not influenced by any acquiescence set on the part of respondents. Procedures used by the Task Force in developing questionnaires to assess RDDE competencies and perceived training needs are reported in this chapter.

Instrument Development Procedures and Specifications

Discussions of specifications for the questionnaires, the content included, and steps in the development process are included in this section.

Specifications for the Instrument

The Task Force proposed that the content of the questionnaires be drawn from the analysis of data yielded in relation to Objective 1 of the current project (see Chapter II above). Until those data were analyzed, it was impossible to determine whether it would be best to develop (a) multiple questionnaires to measure self-reports of competencies within the categories of RDDE, (b) multiple questionnaires to measure self-reports of competencies within other categories of competencies identified through the analysis of Objective 1 data, or (c) a single questionnaire including competencies that cut across categories. Subsequently, a factor analysis of Objective 1 data yielded 12 factors relating to research and research-related tasks; each factor subsumed numerous competencies. For the purpose of developing the questionnaires, the 12 task categories were collapsed as much as possible (as described in a later section of this chapter) to yield seven task categories. Examination of the seven task categories and competencies within categories led to the following four decisions:

1. It was decided that the new task categories should be used as the basis for instrument construction rather than the four categories of RDDE, which lacked empirical support in the data analysis.

2. It was decided that seven rather specific instruments, some of which would include relatively few competencies, would be useful only for extremely specific training programs or activities, of which few real-world examples could be found.

3. Most training programs cut across several of the task categories and their directors would be interested in self-reports of competencies in several of the areas. (For example, each of the three new training consortia funded by the OE Research Training Branch offers training in several of the task categories.)

4. It was decided to develop one "instrument"--an item pool accompanied by directions for administration--that could either be used as a single broad instrument or subdivided in numerous ways to allow flexible use by trainers and employers.

Based on these decisions, the following specifications for the instrument were established: (1) the instrument would include a general set of directions which would be used with the total instrument or any subdivision of it; (2) the format of the instrument (with the exception of refinements to increase clarity and the addition of self-reports of training needs) would follow the format reported in Technical Paper No. 19; (3) the instrument would include a pool of items selected to measure important competencies in each task category; and (4) each item would be keyed to each factor (and, if possible, to the categories of RDDE as well) to facilitate subdividing the instrument by selecting items relevant to specific categories.

Content of the Instrument

Data from Objective 1 provided the base from which competencies were selected for inclusion in the instrument. The Objective 1 data analysis resulted in 12 task factors which appeared to provide the most meaningful grouping of tasks performed in conducting research and research-related activities. Names of the 12 factors are listed below.[1]

Factor 1: Designing research studies and conducting and interpreting data analyses.

Factor 2: Developing instructional materials.

Factor 3: "First-level" administration of inquiry and inquiry-related projects and activities.

Factor 4: Conducting evaluations and constructing and using data collection instruments.

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[1] Generation of these factors and their logical relationships with earlier a priori categories of RDDE are discussed in Chapter II.

Factor 5: Diffusing information and products.

Factor 6: Developing and operating information retrieval systems.

Factor 7: Evaluating inquiry and inquiry-related proposals and monitoring funded projects.

Factor 8: Searching, reading, and reviewing the literature.

Factor 9: Designing and maintaining computer systems and writing computer programs.

Factor 10: No name given to this factor since its interpretation was unclear.

Factor 11: "Second-level" administration of inquiry and inquiry-related projects and activities.

Factor 12: Developing and scoring tests.

For the purpose of constructing the present instrument, the twelve factors were combined logically to form seven task factor categories which appeared to be probable training specializations. These seven task categories are listed below, with the corresponding number from the previous list of factors shown in parentheses.

Category 1: Designing research studies and conducting and interpreting data analyses (1).

Category 2: Developing instructional materials (2).

Category 3: Administering inquiry and inquiry-related projects and activities (3 and 11).

Category 4: Conducting evaluations and constructing and using data collection instruments (4 and 12).

Category 5: Seeking information, storing and retrieving information, and diffusing information and products (5, 6 and 8).

Category 6: Evaluating inquiry and inquiry-related proposals and monitoring funded projects (7).

Category 7: Designing and maintaining computer systems and writing computer programs (9).

Factor 10 was excluded because of its uninterpretability.

The 226 competencies (both skills and knowledge) identified in the Objective 1 interview sample (see Chapter II) were tabulated according to the seven task categories above. Each competency was listed under each task category in which the interviewee indicated that he used the competency. Within each category, frequencies were examined and the competencies that appeared most frequently were selected for possible inclusion in the instrument. The rationale here was to select for assessment those competencies that were often found to be required in the work of persons engaged in research and research-related activities viewed as exemplary.

It should be noted that the list of competencies resulting from the application of the frequency criterion contained several competencies which might be regarded by some persons as inappropriate--or at least nonspecific--to RDDE activities. (Knowledge of printing constraints and mass production techniques for curriculum materials, and knowledge of funding sources for proposals might be cited as examples.) It was felt by the Task Force staff, however, that since these competencies were used frequently by a sample of persons engaged in exemplary RDDE work, they could not be eliminated from consideration as long as they met the criteria listed below which were applied to the other competencies in the list. To have dismissed them on the basis of our own notions of what is or is not relevant to the conduct of research in education would have done grave injustice to the empirical nature of the study.

Each competency selected on the basis of frequency of occurrence was then screened on the basis of the following three criteria:[2]

1. Is the competency trainable; i.e., does it include knowledge or a skill which can be communicated through systematic training or does it represent a personal characteristic (e.g., "ability to be creative") that is unlikely to be enhanced through training?

2. Is the competency the end product of substantive training in another field (e.g., "knowledge of developmental psychology")?

3. Is the competency important or significant; i.e., is it something which cannot be so easily communicated as to be trivial in a training program (e.g., "ability to pay attention to detail")?

If the competency failed to meet Criterion 1 above, it was excluded since the purpose in developing the instrument is to provide a useful tool to persons concerned with identifying competencies where additional training is needed. The competency was also excluded if Criterion 2 was met, since it seems unreasonable to expend scarce resources to provide training for competencies for which well-established training programs already exist and from which persons possessing the competencies could be recruited. The third criterion was included in recognition of the fact that many of the competencies, although important in the conduct of an inquiry activity might well be trivial in a training sense. For example, it seems sufficient to inform potential research managers that one must "pay attention to administrative detail" without contemplating the establishment of courses in "paying attention to details."

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[2] These criteria are modified from those listed in the original proposal: criticality, generalizability, and relevance. The latter was ensured by selecting from a relevant data base; the first was subsumed under criterion three above; and the second was viewed as an abstraction of the frequency criterion employed above. Criteria 1 and 2 listed above were added to those originally proposed.

The application of the above criteria within each category resulted in a list of competencies with 108 entries, distributed across task categories as shown in Table 14 below. Because of the small number of items in categories two, five and six, additional competencies were added to provide a basis for more reliable measurement within those categories.[3] This was done by going back to the data for those categories and selecting competencies which seem important on logical grounds but which fell below the original frequency cut-off point. Additional competencies chosen on this basis are shown in the third column of Table 14.

Table 14

Number of Competencies for Each Task Category Included in the Instrument

Task Category	N of Competencies, Based on Original Application of Criteria	N of Competencies Added to Increase N in Some Categories	Total N of Competencies in Final Instrument in Each Category
1	32	2	34
2	8	8	16
3	17	2	19
4	26	2	28
5	8	5	13
6	5	1	6
7	12	0	12

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[3] Some of these competencies also appeared in other task categories, resulting in gratuitous additions in categories one, three and four.

It should be noted that the total number of competency entries in Table 14 (128) is not the number of different competencies included. Many competencies appear under more than one task factor and therefore are counted more than once in the totals above. The total number of discrete competencies generated through the procedures outlined above is 75. These competencies can be identified by cross-referencing the competency number for each item in Appendix H, with the list of competency numbers in Appendix D.

Development of the Instrument

Instrument development included the following steps:

1. Items were written for each of the 75 selected competencies. Three competencies appeared to contain two important ideas each; therefore, two items were written for each of these competencies, resulting in 78 items in the final instrument.[4]

2. The items were typed in the prescribed format and administered to a convenience sample of three persons knowledgeable in research, evaluation, and development. These persons were asked to comment on ambiguities in items or directions, difficulties with format, etc; their feedback resulted in some revisions.

3. The revised instrument was sent in a second tryout to a random sample of RDDE personnel who had served as interviewees in the

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[4] During item construction, an attempt was made to state the competencies in behavioral terms. Some of those who had conducted the interviews reported in Chapter II felt, however, that this attempt resulted in a distortion of the initial interview data. The Task Force staff felt that it was not as important to state the items more behaviorally as it was to retain the accuracy of the competency data obtained in the actual interviews.

collection of data for Objective 1. Returns from 20 persons were reviewed and no further revisions in the instrument were found to be necessary.

The final instrument that resulted from these steps appears in Appendix G.

Use of the Instrument

The instrument described herein might be used in a variety of ways. For example, persons conducting either pre- or in-service training programs in inquiry-oriented areas might use relevant portions of the instrument to measure program effectiveness by assessing trainee perceptions of their competencies at the beginning and/or termination of the training. Research-training and research-producing agencies might also use the measure to determine areas where more training should be offered to employees, trainees, or members of the association (e.g., AERA). The instrument could also be used by RDDE personnel or trainees as a guide to areas in which they might need additional training. In all the instances above, the results might be more tenuous than if mastery tests of the type described in the following chapter were used; however, as indicated before, there are several reasons why use of the present instrument may be more feasible in many circumstances.

Considerations in Using the Instrument

There are three major considerations in using the instrument, each of which is discussed briefly below.

First, appropriate directions should be given to respondents. A suggested set of directions is included in Appendix G. These directions are designed for use with either the entire instrument or any

Second, it must be determined whether to administer the entire instrument or a subset of items. This choice should be dictated by the purpose for which the instrument is being administered and the relevance of each task category to those purposes. For example, if AERA wished to determine how many of its members in the intermountain states would profit from a short-term, regional training program in RDDE management, they might ask members in those states to respond to an instrument composed of the 19 items designed to measure competencies in task category 3. Items for any task category can be found by use of the key shown in Appendix H.

Third, users must determine whether they wish to collect supplemental data on respondents; for example, personalogical or demographic data on respondents might be collected readily by the addition of relevant items. In the example above, AERA might need to determine whether or not potential trainees would be willing to pay a fee for the training.

CHAPTER IV

DEVELOPMENT OF A PILOT TEST OF SELECTED COMPETENCIES IN EDUCATIONAL RESEARCH, EVALUATION, DEVELOPMENT AND DIFFUSION

DEVELOPMENT OF A PILOT TEST OF SELECTED COMPETENCIES IN EDUCATIONAL RESEARCH, EVALUATION, DEVELOPMENT AND DIFFUSION[1]

Satisfactory instruments designed to assess the competence level of educational research and research-related personnel are not currently available. Such instruments are needed to assess competencies and deficiencies of trainees and employees in educational research, development, diffusion and evaluation (RDDE). An assessment of competencies and deficiencies would provide a rational basis for making recommendations regarding future training programs and manpower needs. Task Force activities in developing pilot tests for measuring RDDE competencies are described in this chapter.

In developing competency measures it is not the purpose of the Task Force to use the tests to assess or diagnose individual achievement. Rather, the purpose is to use the tests to identify whether or not groups of RDDE trainees and workers possess certain important competencies; i.e., the tests would enable one to make statements about the proficiency of groups of individuals (or even the profession as a whole) on selected content. Test scores might subsequently be correlated with demographic variables collected on examinees to provide further understanding about the background and training of RDDE personnel.

Specifically, the Task Force has continued in the present project to attempt to identify the skills and knowledge which are in the shortest supply--i.e., those in which training is most needed.

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[1] All of the activities associated with designing, developing, critiquing, revising and assessing the pilot test described herein were conducted either by or under the direction of Jason Millman and Ellis B. Page, with assistance of other Task Force members and staff.

To accomplish this, the strategy of determining discrepancies between present proficiency and required proficiency in RDDE skills and knowledge was adopted. First efforts to identify required skills were reported in Technical Papers No. 1, 2, 3 and 5 in the Task Force technical paper series. Objective 1 of the current Task Force project represents a further effort to identify required proficiencies; interviews were conducted with persons carrying out exemplary RDDE activities to identify those competencies required in such work. (Skills and knowledge identified through these interviews are reported in Chapter II.) It was originally intended to use these data as a basis for determining what competencies should be measured in the pilot tests described herein. However, because of a USOE request to complete the development of the pilot tests in one-half of the time originally proposed, it was necessary to complete the test development at approximately the same time Objective 1 data were being analyzed. Consequently, it was necessary to use content from Technical Papers 1 and 5 as the basis for determining important competencies to be included in the pilot tests. This has resulted in the competencies paralleling closely the *a priori* categories of RDDE rather than the empirically derived categories reported in Chapter II.

The knowledge derived from administering test items designed to measure present levels of proficiency should permit one to make intelligent statements about areas in which future training is necessary. Administering the tests to sufficient numbers of RDDE persons should provide a good profile of present RDDE proficiency and lead to informed recommendations about future directions of RDDE training.

Test Development Objectives

In the context described above, the specific test development objective of the Task Force was stated as follows: "to design and develop mastery tests of certain competencies in RDDE" (Objective 2.1). During contract renegotiations with OE, that objective was modified because of the shortened period of time allowed for its attainment. The final commitment was to deliver to OE: "(1) one completed pilot mastery test of certain competencies in RDDE and (2) a description of the test on all relevant characteristics." This commitment was fulfilled by the development of two tests shown in the appendices and by the description of the tests contained in this chapter.

The tests were designed expressly as pilot tests to serve as a basis for preliminary data collection and subsequent development of more refined tests of RDDE competencies. Consequently, no norming was undertaken, nor were final checks on validity and reliability made (preliminary information concerning validity and reliability of items is contained herein).

The remainder of this chapter contains (a) a discussion of test development procedures, (b) a description of the resulting pilot tests, (c) copies of the tests, and (d) a listing of the specific skill or knowledge measured in each item.

Test Development Procedures

This section includes a discussion of (a) specification of test content, (b) attempts to identify existing items that might be used, (c) item construction procedures, and (d) item critique, tryout, and revision procedures.

Specification of Test Content

Ideally, a complete, empirically based, empirical map of RDDE, including listing of important skills and knowledge would have been available as the basis for determining the content of the pilot test. However, as mentioned earlier, the speed up of test development required that test content be chosen prior to the completion of the objective 1 data analysis reported in Chapter II; consequently, earlier a priori lists of essential skills and knowledge were used to determine content. Within the parameters of these lists, it was necessary to choose between (a) attempting to test all or most of the specific skills and knowledge viewed as important, or (b) testing a smaller number of the most important skills or knowledge. The Task Force selected the latter option--a sampling of important competencies in the RDDE domain. It was felt that this was the more defensible choice, for two reasons. First, it was much more feasible than attempting to measure all the skills and knowledge viewed as important; budget and time restrictions precluded a comprehensive test of all RDDE skills even if they could have been identified. Second, working with selected competencies would still allow some valid inferences to be drawn even beyond the actual competencies measured, since there are substantial inter-relationships among many competencies.

The competencies used as a basis for writing the test items were chosen by use of the following criteria:

(1) Is the competency trainable, i.e., does it include knowledge or skill which can be communicated through systematic training (as opposed to personal characteristics which are unlikely to be enhanced through training)?

(2) Is the competency the end product of substantive training in a field outside of educational RDDE (i.e., should the competency be gained elsewhere)?

(3) Is the competency important or significant (as opposed to trivial)?

(4) Is the competency likely to be useful in many relevant activities (i.e., is it commonly required in a broad range of RDDE activities)?

(5) Can the competency be efficiently tested in a pilot test of the type proposed by the Task Force?

Application of these criteria resulted in selection of both skills and knowledge in the final list of competencies to be tested. There were approximately twice as many "knowledge competencies" as "skill competencies" chosen. Direct assessment of performance (i.e., use of skills) was viewed as requiring items which would be time consuming to administer, resulting in a narrower sampling of important content. Knowledge was viewed as necessary to be effective in RDDE and was thought in many cases to be a necessary precursor to skill. Assessment of knowledge was thought to provide more efficient items and, therefore, enable a broader sampling of relevant content.

A second decision relating to content was the relative emphasis which should be placed on RDDE. Three decisions were reached and are discussed below:

(1) Diffusion skills and knowledge would not be included in the test. This decision was reached for two reasons. First, none of the Task Force members or staff had particular expertise in this area and it seemed audacious in the extreme to attempt to write items in an area where the writers were not thoroughly prepared.

(2) Development skills and knowledge would be included in the test. This decision was made with the provision that it be contingent upon the ability of W. James Popham, the Task Force member viewed as having expertise in educational development, to identify critical development knowledge and skills and write items to assess these competencies.

(3) Research and evaluation skills and knowledge would be included in the test. The expertise of most Task Force members (including the present authors) lay in these areas and it was felt that the Task Force's major contribution in this pilot test lay in devising items to assess competencies in these areas. Using the criteria discussed earlier, research and evaluation competencies to be assessed were drawn from previous Task Force lists (see Technical Paper No. 5) and included the following:

Research Skills

R1. Drawing implications from results of prior research.

R2. Formulating hypotheses or questions to be answered by the research.

R3. Identifying the population to which results should be generalized and selecting a sample of the population.

R4. Applying experimental design and recognizing and controlling threats to validity.

R5. Selecting or developing techniques of measurement.

R6. Assessing the validity of measurement techniques.

R7. Utilizing appropriate data gathering methods (tests, interviews, analysis of documents, etc.)

R8. Understanding the general role, types, and assumptions of statistical techniques and drawing on such knowledge in using appropriate techniques of data analysis.

R9. Interpreting and drawing appropriate conclusions from data analysis.

Evaluation Skills

E1. Translating broad objectives into specific, observable objectives.

E2. Identifying standards or norms for judging worth.

E3. Selecting (or developing) and using valid techniques of measurement to yield information on outcomes.

E4. Employing appropriate techniques of statistical analysis.

Knowledge of Statistics

S1. Descriptive techniques, their definition and interpretation, including measures of central tendency, variation, correlation and prediction.

S2. Fundamental theorems of finite sample space theory (nature of a sample space and an event, addition rule, multiplication rule, etc.)

S3. Definitions and properties of the principal continuous (normal, chi-square, t, F) and discrete (binomial, multinomial) probability distributions.

S4. Major schools of thought on statistical inference (Neyman-Pearson, Fisherian, Bayesian, likelihood estimation), including principal concepts thereof.

S5. Nature and use of the general linear model including least-squares estimation and distribution theory, which includes analysis of variance methods and the extension of comparative experimental analysis to post hoc multiple comparisons techniques, including Scheffé, Tukey, Dunnett and Dunn.

S6. Consequences of failure to meet assumptions of principal parametric inferential techniques.

Knowledge of Experimental Design

D1. Library knowledge: names of major books and journals, their authors, some familiarity with content, and knowledge of the value ascribed to each work by leaders in the discipline.

D2. Randomization as a means of experimental control and its relationship to inferential statistical methods.

D3. Factors affecting the internal and external validity of experimental and quasi-experimental designs.

D4. Definition of fixed effects, random effects, and mixed effects designs; crossed and nested factors; the nature of interactions, their graphing and interpretation.

D5. Nature and problems in the use and analysis of repeated measures designs.

Knowledge of Psychometrics

P1. Library knowledge (see D1 above).

P2. Fundamental theorems of classical true-score theory (reliability coefficient, variance error of measurement, correction for attenuation, relationship of test length to the variances of x, t, e, and reliability coefficients).

P3. Types of test reliability and validity.

P4. Reliability and validity of sums.

P5. Fundamental postulate and theorems of components and common-factor analysis.

P6. Four factor analysis models: components analysis, image analysis, canonical factor analysis, alpha factor analysis.

P7. Methods of factor rotation (orthogonal) and transformation (oblique): varimax, equamax, quartimax, promax, Harris-Kaiser.

P8. Factors affecting the size of measures of relationship.

Knowledge of Measurement

M1. Library knowledge (see D1 above).

M2. Definition and properties of nominal, ordinal, interval and ratio measurement scales.

M3. Parameters and properties of the major test-score scales including T scores, z scores, CEEB scores, ratio and deviation IQ scores, grade equivalent scores, and percentile scores.

M4. Major forms of assessment of knowledge and cognitive skills, including multiple choice, completion, free response, ranking, matching, etc.

M5. Primary methods of assessing attitudes, including Likert and Thurstone scales, interests and social perception, including semantic differential and Q-sort.

M6. Construction and use of rating scales, including methods of assessing rater agreement.

General Knowledge

G1. The nature of theories, models, and paradigms in the social sciences (including the philosophy of science).

G2. General library knowledge of research and evaluation (see D1 above).

G3. Knowledge of the computer and computer programming.

NOTE: From this point on, the numbering system employed above will be used to refer to the particular skills and knowledge measured by the test. That is, research skills will be noted by an "R," evaluation skills by an "E," statistics knowledge by an "S," etc. It should also be pointed out that all the knowledge items: statistics (S), design (D), psychometrics (P), measurement (M), and general (G) are grouped together under the heading research and evaluation (R-E) knowledge.

Search for Existing Items

An attempt was made to determine if there were already existing items which could be adopted or adapted for use in the pilot test. Contacts were made with the Educational Testing Service (ETS) and the National Council on Measurement in Education (NCME) to see if there were pools of items or tests relating to RDDE content which might be useful for such purposes.

ETS items. The following ETS tests were examined for possible items:

1. Graduate Record Examinations (Psychology, Education, Sociology, and Philosophy)
2. Undergraduate Record Examinations (Psychology, Education, and Sociology)
3. College Level Examination Program (Computers and Data Processing, Educational Psychology, General Psychology, History of American Education, Human Growth and Development, Statistics, Tests and Measurements, and the pretest on Elementary Computer Programming.)

4. National Teacher Examinations (Common Exams--Professional Education; Early Childhood Education; Education in the Elementary School; and Reading Specialist--Elementary School)
5. Teacher Education Examination Program (General Professional Exams, Early Childhood Education, Elementary School Education).

There were found to be few items in any of the above tests which were relevant for the specific purposes of this activity. It was felt that the gain in using the few items found to be relevant was not worth the losses associated with: (a) the efforts necessary to gain permission to use the items, and (b) the fact that particular items selected for relevance to RDDE would not represent a sample of any generalizable sort and therefore could not be related meaningfully to ETS norms on the respective tests. Consequently, no ETS items were used in the pilot test described herein. However, some items in the ETS tests did suggest formats or approaches to assessment which were adopted in writing some of the items for the pilot test.

NCME items. NCME's Competency Tests in Tests and Measurement (Forms A and B) were also examined. Although some of the items suggested item formats which were used in writing some pilot test items, none of the NCME items were used in the present pilot tests.

Item Construction

A pool of 230 original items on research and evaluation was written by Drs. Millman and Page. A pool of 23 development items was submitted by Dr. Popham.[2] Both pools of items were almost exclusively objective items, reflecting an earlier decision to adhere to this type of item in the pilot test. This decision resulted from early critiques of preliminary items relating to time consumption and feasibility. Although it was acknowledged that there is inevitably some hiatus between objective, paper and pencil testing and "live performance" (and perhaps more so than with more "naturalistic" performance tests), other considerations influenced the decision. For example, evaluating direct performance items throughout tryout phases requires greater expenditures of time and money than were available for the development of this pilot test. Secondly, objective tests allowed a greater number of competencies to be assessed efficiently. Third (and perhaps most important), there were serious concerns about the test being used by persons with limited expertise in the content being measured. To the extent this occurred, it seemed critical to provide an objective scoring format rather than perpetuating the fallacy that untrained persons could score essay-type responses validly. Finally, it seemed that a majority of the important competencies could be tested as readily with objective as with other types of items.

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[2] These items were drawn primarily from items Popham had written earlier, some of which had also been used by the author's permission in "Evaluation: The Development of Instructional Products, Form X." Southwest Regional Educational Laboratory, Inglewood, California, 1967.

Item Critique, Tryout, and Revision

For the research and evaluation items, the critique included the following steps: (1) Drs. Millman and Page critiqued one another's items, (2) all items were critiqued in terms of content and technical adequacy by two experts in research and evaluation,[3] and (3) Millman and Page revised the items on the basis of the three independent critiques of each item.

The development items were critiqued by Millman and Page in terms of general technical considerations (not content). Those items viewed as adequate on technical grounds were critiqued by an expert in educational development,[4] who was asked to do the following:

> "1. Assess whether the items measure important competencies (skills or knowledge) in educational development. Note any items which you feel do not measure important development competencies.
>
> 2. Assess whether the set of items fails to include some important development competencies. . . . If so, could you write a few items to cover such additional important competencies?
>
> 3. Assess whether the items are good items technically. If not, could you suggest modifications to improve them?" (Personal correspondence to Leslie Briggs, July 28, 1971.)

In the response to the above points, (1) it was indicated in the critique that all of the original items were relevant to the development process, (2) it was pointed out that the original items were exclusively on the development of instructional products and, consequently, additional items of broader scope were suggested, and (3) revisions were suggested in some items because of technical inadequacies. Thirty-three additional items were submitted by Briggs, 16 of which were discarded because of technical inadequacies. The resulting item pool was thus increased (by the addition of the 17 remaining items), but still emphasized primarily development of instructional products.

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[3] Dr. Gene V Glass and Dr. Kenneth D. Hopkins.

[4] Dr. Leslie J. Briggs.

After revision of all items, including discarding "bad" items, there were 137 research and evaluation items and 40 development items in the item pool. After this initial screening, it was intended that all items were to be ". . . tried out with a small number of subjects to identify ambiguities in items, derive preliminary estimates of item difficulty, etc. This will not represent an attempt at norming, however. . ." (amendment to USOE grant OEG-0-71-0617(520)). This tryout did not represent an attempt at norming (even on a pilot basis); that and routine reliability and validity assessment were to be conducted subsequently. Only preliminary assessment in these areas was viewed as appropriate to the development of the pilot tests.

In choosing the tryout group, an attempt was made to administer each pool of items to persons known to have relevant knowledge and skills. This resulted in a convenience sample of faculty members and graduate students in six major universities. Each member of the sample was chosen on the basis of being skilled or knowledgeable (to at least some degree) about the relevant content--i.e., there were no persons who were viewed as completely naive in the content area.[5] On this basis, 100 persons were identified and asked to assist with the test development. Seventy-six persons complied with this request. The two item pools (development items in one and research and evaluation items in the other) were reproduced in two separate "tests" for the tryout. The number and type of persons who took each of these tests are shown in Table 15.

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[5] The selection was made on the basis of recommendations of either Task Force members or colleagues who were thoroughly instructed in the types of individual desired for inclusion in the tryout. The following persons nominated persons for inclusion at the following institutions: Ronald D. Anderson and Blaine R. Worthen (University of Colorado); Leslie J. Briggs (Florida State University); Tom Hastings (University of Illinois); Ellis B. Page (University of Connecticut); W. James Popham (University of California at Los Angeles); and James R. Sanders (Indiana University).

Table 15

Type and Locale of Persons Participating in Item Tryout

Test	Institution	Number of Tests:		Persons Completing Tests:	
		Sent	Returned	Faculty	Graduate Students
Research and Evaluation	U. of Connecticut	15	11	4	7
	U. of Illinois	10	8	4	4
	Indiana U.	10	7	5	2
	U. of Colorado	10	9	1	8
Development	UCLA	25	17	0	17
	Florida State U.	15	11	3	8
	U. of Colorado	15	13[a]	12	1
Totals:		100	76	29	47

[a] Five of these persons did not complete all items; however, they wrote a critique of the test itself.

The 76 persons who responded included faculty at all academic ranks, doctoral students, and a few advanced master's degree candidates. With few exceptions, these were persons with demonstrated competence in the relevant areas. For example, the graduate students and faculty who took the research and evaluation test were drawn primarily from the following programs:

educational research and psychology, the University of Connecticut; Center for Instructional Research and Curriculum Evaluation, the University of Illinois; educational psychology, Indiana University; and the Laboratory of Educational Research, University of Colorado. For the development test, examinees were graduate students from the Instructional Product Development Program, UCLA; faculty and graduate students from the educational development program, Florida State University; and faculty members (or full-time professional staff) of three curriculum development projects at the University of Colorado (Biological Sciences Curriculum Study, Earth Sciences Curriculum Project, and the Social Science Educational Consortium).

Examinees were asked to: (1) attempt to respond correctly to each item on the test administered to them, and (2) write any comments they had relating to inadequacies or ambiguities in the items.

Most comments were directed at item ambiguities, unintended cues to the correct response, etc., and were used in revising the items. However, on the development test, there were several negative comments relating to whether or not the test measured important development competencies. Five persons from the Biological Sciences Curriculum Study (BSCS) stopped short of responding to all development items because of their feeling that these represented a superficial and misdirected approach to curriculum development. Their concerns are reflected in the following statement:

> This . . . effort [the Task Force attempt to measure educational development] is, first of all, focused on the wrong target, namely a focus on people rather than on their products. Studies of creativity and creative processes were apparently ignored resulting in a naive view of curriculum development processes and competencies. If one were to center research on competencies of development personnel, creativity would be an important characteristic.[6] Note that the very statement of the AERA Task Force is naive, centering on the measurement of knowledge and skills. (Personal communication from Jim Robinson, Richard Tolman, Jim Eckenrod, Fred Rasmussen, and Joe Steele, August 24, 1971. Footnote reference added.)

Since these reactions suggested that a completely different approach to measuring development competencies should be taken, they were not used in revising the pilot test in development. They are reported here, however, to alert the reader to the fact that there is a strong minority view which suggests that the concept of development reflected in this pilot test is rejected by some prominent curriculum developers.[7]

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[6] Research of the Task Force on competencies of development personnel (reported in Chapter II) lends some support to this statement. Several competencies had some relationship to "creativity." It should be noted here, however, that the Task Force has no intent to overlook creativity. Indeed, several discussions centered around the importance of creativity and several affective variables in educational development before it was decided that skills and knowledge were the competencies which could be measured at this time. Albeit an important characteristic, creativity is without reputable means of measurement and was omitted for this reason and not because of any naiveté about how important a role it plays.

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[7] This reaction of the BSCS examinees simply highlights the fact that there is, at this point in time, no real consensus as to what competencies are important in educational development; indeed, "developers" are not of one mind concerning what development comprises. There seem to be at least two distinct schools of thought about development of instructional products. One view (that implicit in the work of the Task Force and outside expert who developed the development items) has wide currency among educationists who have established programs to train persons in product development (e.g., the UCLA Instructional Product Development Program, the educational development programs at the Florida State University and the Pittsburgh R and D Center, and the Department of Instructional Research and Development at Brigham Young University). Stating measurable objectives, identifying entry capabilities of learners, sequencing concepts in instruction, and conducting formal evaluations of the finished products are stressed in this approach as essential adjuncts to the actual writing of the materials. The second view (that expressed by the BSCS examinees) seems to be most predominant among persons engaged in contract development of curriculum materials or packages--often scholars from the various disciplines (e.g., BSCS, PSSC, ICSM). Here the approach to development seems to be to gather a team of bright, creative individuals with knowledge about the relevant disciplines and focus the production of the materials around how to present in an effective, interesting fashion the basic content and structure of the discipline. Persons in this second school of thought seem to view adherents to the first as proponents of misguided, mechanistic approaches to development which will result in uninteresting, sterile products. Proponents of the first view are likely to view their counterparts as engaging in unsystematic development efforts which are completed with too little real evaluation or specification of precise behaviors or concepts which are to be taught. There are also differences relating to the issue of "who is the developer?" Educationists conducting training programs seem to assume that one provides important development concepts and skills to each trainee (e.g., skills in sequencing, evaluation, and using A-V equipment) and that most trainees go on to be development generalists--i.e., you train educational developers, per se. Developers on curriculum development projects seem to view development as a team effort and view with suspicion persons trained "superficially" in a broad sampling of development or development-related competencies. They prefer to recruit several persons, each of whom has specialized training relevant to the project (e.g., an evaluator, an A-V man, several persons trained in the relevant subject matter, an editor or journalist). In their view you do not train educational developers per se, but make up development teams of bright, creative persons with expertise gained in relevant, established training programs.

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7 (cont'd) In any event, there are at least two schools of thought regarding the proper--or most fruitful--approach to the educational development process and, consequently, two very different views of the assessment of development competencies. It seems clear that there can be no single acceptable approach to measuring these competencies until there is substantial agreement on what constitutes the educational development process itself. Although both views described above have doubtlessly been oversimplified (if not caricatured), their existence points to a serious difficulty which is likely to be encountered in any effort to define educational development either through measurement efforts such as that described herein or the establishment of training programs by funding agencies. This is an interesting but serious problem confronting the USOE in their efforts to establish programs to train educational developers. It may be that attempting to identify the critical content of development by bringing together adherents of both schools of thought (e.g., having BSCS personnel sit down with persons like Popham and Briggs) in a small conference to react to data on development competencies reported in Chapter II would be a useful precursor to further plans to establish programs to train educational developers. Such efforts may at least partially eliminate the present disagreements about development which are uncomfortably akin to the fabled attempts of the blind men to describe the elephant.

Examinee responses to all items were scored, coded, keypunched, and submitted to a computer item analysis (Laboratory of Educational Research FORTAP program). Item analyses were run separately on the 40 development items and the 137 research and evaluation items. The results of these analyses, including: (1) a reliability estimate, (2) a mean score for all examinees, (3) measures of variability, and (4) for each item, the difficulty level, point-biserial _r_, and number responding to each option, are presented in Tables 16 and 17.

Table 16

Summary of Item Analysis of Research and Evaluation Items
(N = 35)

Item No.	Difficulty Level	Point Biserial _r_	Number Choosing Each Option				
			A	B	C	D	E
1	.97	.471	0	0	34*	1	0
2	.83	.002	0	29*	6	0	0
3	.89	.080	31*	2	0	0	1
4	.91	-.019	32*	3	0	0	0
5	.60	.184	21*	13	0	0	0
6	.89	.130	4	31*	0	0	0
7	.94	-.107	33*	2	0	0	0
8	.89	.422	31*	4	0	0	0
9	.37	.094	9	6	2	13*	5
10	.89	.108	0	3	31*	1	0
11	.94	.020	0	33*	2	0	0
12	.77	.272	1	6	27*	1	0
13	.66	.218	0	0	2	10	23*
14	.57	.110	0	7	3	5	20*

*correct response

Table 16, continued

Item No.	Difficulty Level	Point Biserial r	Number Choosing Each Option A	B	C	D	E
15	.83	.411	0	4	29*	0	2
16	1.00	.000	0	35*	0	0	0
17	.97	-.020	1	34*	0	0	0
18	.86	.011	5	30*	0	0	0
19	.86	.277	5	30*	0	0	0
20	.63	.235	22*	12	0	0	0
21	.94	.480	1	0	33*	1	0
22	.60	.174	14	21*	0	0	0
23	.57	.546	20*	0	3	8	3
24	.80	.198	28*	6	0	0	0
25	.71	.459	0	1	25*	7	0
26	.49	.181	17*	0	0	13	4
27	.43	.435	15*	3	0	1	16
28	.54	.386	16	19*	0	0	0
29	.86	-.047	4	30*	0	0	0
30	.94	.011	1	1	33*	0	0
31	.69	.210	1	24*	0	7	3
32	.97	-.211	0	34*	1	0	0
33	.91	.216	2	0	1	32*	0
34	.60	.369	4	6	21*	1	1
35	.94	-.097	0	33*	0	1	0
36	.77	.391	7	27*	0	0	0
37	.57	.358	20*	2	1	12	0
38	.60	.086	3	4	21*	7	0
39	.57	.395	20*	10	4	1	0
40	.63	.296	3	2	8	22*	0
41	.94	.030	1	33*	1	0	0
42	.86	.439	2	0	1	2	30*

*correct response

Table 16, continued

Item No.	Difficulty Level	Point Biserial r	Number Choosing Each Option A	B	C	D	E
43	.77	.153	7	27*	0	0	1
44	.54	.099	19*	0	11	0	5
45	.63	.273	22*	8	2	0	3
46	.97	.471	1	34*	0	0	0
47	.94	-.175	33*	2	0	0	0
48	.86	.258	3	2	0	30*	0
49	.66	.447	23*	5	0	7	0
50	.71	.600	1	25*	0	9	0
51	.71	.213	3	4	25*	3	0
52	.66	.266	0	5	23*	1	6
53	.97	-.211	0	1	34*	0	0
54	.91	-.165	0	32*	3	0	0
55	1.00	.000	0	0	35*	0	0
56	.94	-.001	33*	1	1	0	0
57	.57	.267	1	20*	14	0	0
58	.31	.206	11*	7	16	0	0
59	.66	.567	4	23*	7	0	0
60	.97	-.020	34*	1	0	0	0
61	.91	-.060	3	32*	0	0	0
62	.91	.159	0	32*	1	1	1
63	.86	.180	0	0	30*	0	5
64	.89	.251	1	31*	0	3	0
65	.49	.253	17*	17	0	0	1
66	.31	.411	11*	2	0	2	19
67	.66	.203	23*	11	0	1	0
68	.77	.342	8	27*	0	0	0
69	.77	.348	8	27*	0	0	0

*correct response

Table 16, continued

Item No.	Difficulty Level	Point Biserial r	Number Choosing Each Option A	B	C	D	E
70	.74	.327	26*	9	0	0	0
71	.80	.073	28*	7	0	0	0
72	.77	.240	27*	0	0	0	7
73	.71	.625	0	5	25*	3	2
74	.77	.559	0	0	1	7	27*
75	.94	.079	33*	2	0	0	0
76	.83	.399	29*	5	0	0	0
77	.63	.230	13	22*	0	0	0
78	.80	.368	7	28*	0	0	0
79	.89	.101	31*	3	0	1	0
80	.91	.232	1	0	0	32*	0
81	.97	.471	0	0	34*	1	0
82	.94	.020	1	1	0	33*	0
83	.97	.062	0	0	34*	1	0
84	1.00	.000	0	0	35*	0	0
85	.97	-.020	34*	0	1	0	0
86	.94	.353	0	33*	2	0	0
87	.80	.464	0	6	28*	1	0
88	.66	.337	7	23*	4	0	0
89	.89	-.077	3	0	1	31*	0
90	.60	.355	0	21*	4	8	0
91	.66	.323	10	1	23*	1	0
92	.83	.465	5	29*	1	0	0
93	.51	.519	5	4	8	18*	0
94	.91	.346	2	32*	0	1	0
95	.97	-.292	0	34*	0	0	0
96	.91	-.052	32*	0	0	2	0
97	.34	.160	2	12*	6	0	14

*correct response

Table 16, continued

Item No.	Difficulty Level	Point Biserial *r*	Number Choosing Each Option				
			A	B	C	D	E
98	.83	.092	0	3	29*	2	0
99	.77	.413	27*	1	3	2	1
100	.74	.166	4	3	26*	2	0
101	.63	.151	22*	12	1	0	0
102	.43	-.235	0	18	15*	2	0
103	.71	-.138	4	25*	6	0	0
104	.29	.174	10*	13	12	0	0
105	.80	.283	28*	5	1	0	0
106	.69	.005	11	24*	0	0	0
107	.89	.315	31*	3	1	0	0
108	.57	.505	1	13	20*	1	0
109	.83	.658	2	29*	4	0	0
110	.71	.369	2	1	5	25*	2
111	.69	.469	1	7	3	24*	0
112	.69	-.176	1	24*	2	1	7
113	.89	.401	0	0	31*	1	3
114	.89	.351	2	0	1	31*	1
115	.94	.284	33*	0	2	0	0
116[a]	.97	.348	1 (F-0)	34* (G-0)	0 (H-0)	0 (I-0)	0 (J-0)
117[a]	.86	.459	2 (F-1)	0 (G-0)	1 (H-1)	29* (I-1)	0 (J-0)
118[a]	.91	.484	0 (F-32*)	0 (G-0)	0 (H-1)	0 (I-0)	1 (J-0)
119[a]	.89	.479	1 (F-0)	0 (G-0)	1 (H-0)	1 (I-30*)	1 (J-1)
120[a]	.83	.441	1 (F-0)	0 (G-0)	1 (H-3)	0 (I-0)	29* (J-0)
121[a]	.94	.353	0 (F-0)	0 (G-0)	32* (H-0)	1 (I-0)	0 (J-1)

*correct response

[a] This item had 10 options, A - J

Table 16, continued

Item No.	Difficulty Level	Point Biserial r	Number Choosing Each Option A	B	C	D	E
122	.89	.458	1	3	31*	0	0
123	.91	.232	0	32*	0	3	0
124	.66	.610	5	23*	0	3	4
125	.80	.209	28*	7	0	0	0
126	.46	.270	16*	19	0	0	0
127	.37	.206	22	13*	0	0	0
128	.86	-.015	30*	5	0	0	0
129	.89	.137	4	31*	0	0	0
130	.86	.543	4	30*	0	0	0
131	.97	.348	1	0	34*	0	0
132	.91	.321	32*	1	1	1	0
133	.94	.284	0	33*	0	1	0
134	.20	.290	0	1	7	26*	0
135	.71	.108	2	5	25*	1	1
136	.91	-.003	0	0	2	32*	0
137	.57	-.064	20*	6	6	2	0

$\overline{X}$ = 105.54 S = 12.59 Range = 71 - 127 Reliability[b] = .878

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[b] The FORTAP program computes a Hoyt reliability coefficient.

Table 17

Summary of Item Analysis of Development Test
(N = 36)

Item No.	Difficulty Level	Point Biserial r	Number Choosing Each Option				
			A	B	C	D	E
1	.94	.389	34*	1	0	0	0
2	.67	.497	10	24*	0	0	0
3	.75	.169	7	27*	0	0	0
4	.67	.251	24*	11	0	0	0
5	.92	.470	33*	3	0	0	0
6	.64	.331	10	23*	0	0	0
7	.75	.312	5	27*	0	0	0
8	.89	.248	2	32*	0	0	0
9	.78	.376	28*	4	0	0	0
10	.97	.295	35*	1	0	0	0
11	.81	.116	1	29*	0	0	1**
12	.75	.401	6	27*	0	0	1**
13	.86	.120	31*	4	0	0	1**
14	.92	.414	2	33*	0	0	0
15	.83	.428	30*	4	0	0	0
16	.42	.138	18	15*	0	0	0
17	.94	.086	2	34*	0	0	0
18	.94	.187	1	34*	0	0	0
19	.83	.159	2	0	30*	4	0
20	.92	.442	0	0	1	1	33*
21	.94	.019	2	0	0	34*	0
22	.89	.101	4	32*	0	0	0
23	.92	.386	33*	3	0	0	0
24	.94	.154	0	1	34*	0	0

*correct response

**The same person marked option E for questions 11, 12 and 13, even though E was not a legal response.

Table 17, continued

Item No.	Difficulty Level	Point Biserial r	Number Choosing Each Option A	B	C	D	E
25	.81	.350	0	2	2	29*	0
26	.94	-.082	1	34*	1	0	0
27	.47	.174	1	17*	0	15	0
28	.42	.326	0	2	18	15*	0
29	.83	.097	30*	6	0	0	0
30	.89	.298	32*	0	0	3	0
31	.97	.201	0	0	1	35*	0
32	.39	.192	11	1	14*	8	0
33	.97	-.034	1	0	0	35*	0
34	1.00	.000	0	0	0	36*	0
35	.89	.101	2	1	1	32*	0
36	.78	.357	2	4	0	28*	0
37	.81	.155	2	4	29*	0	0
38	.58	.331	11	21*	1	1	0
39	.69	.303	25*	0	8	1	0
40	.94	.389	0	34*	1	0	0

$\overline{X}$ = 32.28   S = 3.60   Range = 25 - 38   Reliability[a] = .605

[a] The FORTAP program computes a Hoyt reliability coefficient.

Three cautions should be kept in mind in interpreting the data from these item analyses. Each is discussed briefly below.

1. The only intent in conducting this analysis was to provide preliminary results to the item writers to enable them to revise items as necessary. Further item analysis on more representative samples of examinees will be necessary before stable item data can be expected.

2. In the absence of definitive demographic data about members of the sample, it is difficult to know how to interpret these item data. For example, items which appeared too simple because all or most examinees responded to them correctly may merely reflect the fact that the 76 examinees used herein are unusually competent. Without direct data on competency from other sources, such issues cannot be satisfactorily resolved.

3. The reliability coefficients recorded above apply to the pools of items, not to the final subsets of items chosen from these pools for inclusion in the final pilot tests.[8]

Results of the item analyses were sent to Millman and Page (research and evaluation items) and Popham (development items), along with all comments of examinees. These were used as a basis for further revision or elimination of items. Some items which failed to discriminate were retained for three reasons: (1) lack of discrimination was thought to be at least partly attributable to a very competent group of examinees (see the discussion under "caution no. 2" above), (2) the items in question seemed important to increase the breadth of coverage, and (3) some of these items measured skills viewed as most essential.

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[8] It should be noted in passing that traditional concern over reliability, most appropriate for tests designed to diagnose and measure individual achievement, is relatively less important here. The concern is not with the accuracy with which we measure a person's true score but rather with the accuracy with which we are able to assess the profession's ability to respond correctly to a particular item (somewhat analagous to the problems facing National Assessment).

After revising or discarding items on the basis of comments or item analysis data, the item writers used the pool of good items as a basis for completing the development of the pilot tests. This included the following steps:

1. Clusters of items, overlap among items, and gaps in coverage were examined. On this basis, several items were eliminated and two new items were added.

2. Final decisions were reached about the composition of the tests. It was decided to leave the research and evaluation items together in a single test because of the large number of items which measured a competency essential to both research and evaluation. It was further decided to select from the good items to form two research and evaluation test forms as nearly parallel as possible. It was also decided to put all development items in a separate test, since the item pool was too small to enable it to be split into even approximately parallel item sets to be added to the two research and evaluation forms.

3. Final choices were made of 34 items for the development test and 90 research and evaluation items, split into two 45-item tests. These two test forms were matched closely on content and quite closely on item difficulty, as shown in Table 18.

Table 18

Distribution of Difficulty Measures for Forms A and B:
Test of Educational Research and Evaluation Competencies

Number of Examinees Choosing Correct Response	Form A	Form B
32 or more	9	10
28 - 31	14	12
24 - 27	7	7
20 - 23	9	9
16 - 19	2	2
12 - 15	2	1
8 - 11	1	1
4 - 7	0	1
Not available[a]	1	2
Total	45	45

[a] Two items were completely new; one item, because of a typographical error in the preliminary test, was not numbered and hence was omitted from the item analysis.

Final Versions of Pilot Tests

The completed pilot tests are shown in the appendices. The two 45-item forms, Test of Educational Research and Evaluation Competencies, Forms A and B, are presented in Appendix I, along with directions for administering the test. The correct response is keyed for each item. The 34-item Test of Educational Development Competencies is shown, with keyed responses and directions for administration, in Appendix J.

Each item in the Test of Educational Research and Evaluation was classified according to its primary and secondary emphasis in the following three categories:

(1) Research skills (designated as R)

(2) Evaluation skills (designated as E)

(3) Those areas of knowledge (of statistics, experimental design and psychometrics, for example) which are essential for both research and evaluation (designated as R - E).

The final distribution of items in terms of primary and secondary emphasis within each of these categories is as follows: Research skills, 23 items with primary emphasis and 6 items with secondary emphasis; Evaluation skills, 5 items with primary emphasis and 1 item with secondary emphasis; and Research-Evaluation knowledge, 67 items with primary emphasis and 35 items with secondary emphasis.[9] Summing across categories, this resulted in 90 items with primary emphasis in research, 41 with secondary emphasis in research, 72 with primary emphasis in evaluation, and 36 with secondary emphasis in evaluation.

Within these broad categories, items were also classified as to specific competencies they measured. The final distribution of items on specific competencies is shown below in terms of primary and secondary emphases (the latter appears in parentheses throughout this list).

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[9] The number of items listed above exceeds 90, the number of items in the tests, since some items measured more than one competency and were classified as having primary emphasis in more than one category.

	Number of items with:	
	primary emphasis	secondary emphasis
Research Skills		
R 1[a]	1	0
R 2	1	0
R 3	3	0
R 4	4	0
R 5	2	0
R 6	3	1
R 7	1	0
R 8	3	1
R 9	5	4
Evaluation Skills		
E 1	1	0
E 2	1	0
E 3	1	1
E 4	1	0
Knowledge of Research - Evaluation		
Statistics:		
S 1	19	3
S 2	2	0
S 3	0	1
S 4	2	0
S 5	1	8
S 6	1	0
Experimental Design:		
D 1	1	0
D 2	0	5
D 3	10	1
D 4	2	0
D 5	1	0

[a] Descriptions of all skills and knowledge are given in the early pages of this chapter.

	Number of items with:	
	primary emphasis	secondary emphasis
Psychometrics:		
P 1	1	0
P 2	4	1
P 3	4	4
P 4	1	0
P 5	1	1
P 6	1	2
P 7	0	1
P 8	0	1
Measurement:		
M 1	4	0
M 2	1	0
M 3	3	0
M 4	1	1
M 5	0	3
M 6	1	3
General:		
G 1	2	0
G 2	2	0
G 3	2	0

Use of the Pilot Tests

It should be reiterated that the pilot tests described herein were not designed for use in making important decisions about individuals. Although persons could use individual items from this test (or even the entire test) for that purpose, it should be kept in mind that these tests are still in preliminary, exploratory stages and would need extensive research, refinement and norming before such use would be completely warranted.[10] The tests are intended to provide a basis for attempting to assess the proficiency of groups of persons--even the profession as a whole--on selected competencies viewed as essential to the conduct of educational research, evaluation and, to a lesser extent, development.

In use of the Test of Educational Development competencies, the reader should keep in mind two points discussed earlier: (1) the test focuses primarily on one type of development--the development of instructional products, and (2) within that area, there is serious disagreement on the part of some examinees as to whether the test measures important competencies.

Obviously, the tests could be used independently or combined for administration, depending on the purposes underlying their use. Also, items could be selected to measure specific competencies or classes of competencies if such sub-divisions were viewed as useful by research trainers, funding agents, or AERA. To facilitate such flexibility in use, a key to the competencies measured by each item (in terms of both primary and secondary emphasis) is provided in Appendix K.

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[10] In the interim before adequate norming is conducted, persons who administer these items to any sizable group are invited to send item analyses data, along with a detailed discription of the examinees, to Blaine R. Worthen, Laboratory of Educational Research, University of Colorado, Boulder, Colorado 80302.

CHAPTER V

A SURVEY OF EXISTING TRAINING OPPORTUNITIES IN EDUCATIONAL RESEARCH AND RESEARCH-RELATED AREAS

A SURVEY OF EXISTING TRAINING OPPORTUNITIES IN EDUCATIONAL RESEARCH AND RESEARCH-RELATED AREAS

In response to the need for summary information on training opportunities in educational research, the American Educational Research Association's Task Force on Research Training undertook as one of its objectives the identification of formal training programs in educational research and related areas. The intention of the Task Force was described by two subobjectives:

> 4.1 To determine how many formal programs exist specifically for training RDDE personnel in education.
>
> 4.2 To determine the characteristics of these formal training programs . . .

The effort was to include compilation of a directory of educational research and research-related training programs in the U.S. This chapter is an account of the Task Force effort to attain this objective and a description of its results.

Procedures

Development of Definitions

Early in the work on this objective, it became clear that a careful definition of terms was of utmost importance. Not only was it necessary to define "educational research and research-related areas" in a way which would convey adequate meaning; it was also crucial to decide in advance what constituted a "formal training program."

For the purposes of this study, educational research and research-related areas were defined as the following: educational research; the design and development of instructional products and programs; the dissemination of products and curricula to the educational community; and the evaluation of materials and programs, both as part of the development effort and as an ongoing monitoring process. These areas are jointly designated as educational RDDE.

The attempt to define formal training programs raised several questions. Some categories were easily decided. For example, a Ph.D. degree program in educational research methodology and design clearly fit; so did an M.A. curriculum in educational product development. But what about an education program including a sprinkling of research methods and statistics courses as part of the general requirements for the Ph.D. degree? Would the recipient of a Ph.D. in science education from such a program be described as having received formal educational research training?

The questions were even more difficult and more numerous when the training activities of organizations and agencies which do not offer academic degrees were considered. A semi-annual six-week institute on evaluation methods and techniques, conducted by a state education department for its Title I evaluation staff, was obviously an activity which should be included. Monthly seminars on advanced statistical methods offered by an educational testing organization could also be included comfortably. On the other hand, how should one deal with a three-day workshop on evaluation theory given once by a school study council for its members? And what of the whole area of on-the-job training that occurs when an employee is exposed to new problems and new ideas from the more experienced professionals around him?

These and many other questions were raised by the Task Force staff in establishing a definition of "formal training programs." Consideration of the intended product of this objective, along with a review of the financial and manpower resources available for its accomplishment, led to the following decisions:

1. The institutions, organizations and agencies in the survey were divided into two broad categories: those which grant academic degrees and those which do not.
2. For the degree granting institutions, a formal training program in educational research and research-related areas was described as a program with an identifiable field of specialization in educational research, development, diffusion or evaluation which is equivalent to other areas of specialization in the school of education. We did not wish to restrict our definition to those programs with an institutionally-designated "major" in educational research, since it was our feeling that such a definition would exclude a large number of programs which do provide substantial research training. On the other hand, we were not persuaded by the argument that a Ph.D. program in education is, by definition, a research program -- especially in the light of convincing evidence that only a small proportion of Ph.D. recipients go on to do research.[1]
3. For those organizations and agencies which do not grant academic degrees, formal training opportunities in educational RDDE were described as those training activities which are a scheduled and ongoing part of the overall activities of the organization. No limitations were set on the type of vehicle employed. Activities included were lectures, workshops, seminars, institutes, conferences, and the like. Similarly, no requirements were given for

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[1] See Heiss, in Buswell, et. al. (1966).

the frequency or duration of the activities: they might occur once a week or once a year; they might last for one or several days, or for several weeks. Our definition did not include, however, the less structured, day-to-day training experiences of an employee which take place naturally through his exposure to the projects and people around him. The Task Force staff felt that such experiences, though undeniably valuable, cannot be adequately and meaningfully described for the purposes of this study.

Identification of Organizations to be Surveyed

The next step toward attainment of this objective was to identify those institutions, organizations and agencies which offer RDDE training. Several categories of agencies to be included in the survey were identified by the Task Force staff: colleges and universities, state departments of education, USOE-supported R and D centers and regional laboratories, Federal agencies, regional education and school study councils, professional education associations and similar groups, and private research and development organizations.

Within some categories (e.g., state education departments, labs and R&D centers) all the agencies in the category could easily be included in the survey. For the college and university category, criteria such as the type of degree granted and number of students enrolled could be used to exclude institutions very unlikely to offer RDDE training programs (e.g., a private undergraduate institution with an enrollment of 2,100 students), thus reducing the institutions to be surveyed in this category to a manageable number. The great majority of regional education and school study councils could be readily identified through the membership roster of the National School Development Council.

For the remaining three categories, however -- Federal agencies, professional associations and private R&D organizations -- it seemed necessary to employ some method of logical selection in order to identify the groups most likely to conduct research training activities. Selections in these three categories were made by the Task Force staff in consultation with associates of the Laboratory of Educational Research at the University of Colorado and representatives of USOE.

The resulting categories of institutions and organizations included in the Task Force survey consisted of the following:

1. Colleges and universities. The Education Directory for 1969-70 was searched and a list was compiled of all doctoral degree granting institutions and those master's degree granting institutions with student enrollments above 2000. The approximately 475 institutions on this list were surveyed for graduate training programs in educational RDDE.

In order to identify the small number of institutions with undergraduate programs in educational RDDE, the Task Force staff contacted Dr. Robert Bargar at The Ohio State University and Dr. John Feldhusen at Purdue University. On their advice and knowledge of undergraduate training, it was decided that the recent study by Dr. Ewaugh Fields of Drexel University included information on all relevant undergraduate training programs and should serve as the basis for examing undergraduate programs.

2. State departments of education. All 50 state departments of education, plus the education departments for the District of Columbia,

Puerto Rico and the Virgin Islands were included in the survey of states. (See Appendix L.)

3. USOE-supported R&D centers and regional educational laboratories. A list of the eleven regional laboratories and eight R&D centers was furnished by the Research Training Branch in USOE. (This list is shown in Appendix L.)

4. Regional education and school study councils. The 82-member roster of the National School Development Council, which was revised in May 1971, was used to identify groups in this category, all of which were included in the survey. (The list is given in Appendix L.)

5. Professional education associations. A list of associations likely to be engaged in educational research training was compiled by the Task Force staff and associates of the Laboratory of Educational Research at the University of Colorado. The Education Directory listing of professional associations was reviewed by the staff for additional groups. Organizations which had been considered likely, but which were known by one or more staff members not to be engaged in RDDE training activities, were deleted. The remaining list contained the names of eleven professional associations. (These are given in Appendix L.)

6. Federal agencies. At the request of the Task Force, personnel in USOE agreed to furnish the names of Federal agencies to be included in the survey. Some agencies which had been considered likely were deleted following telephone conversations with OE representatives. A list of eight agencies and offices, primarily within USOE, was supplied to the Task Force. (The list appears in Appendix L.)

7. Private research and development organizations. USOE made available to the Task Force a list of industrial research laboratories whose areas of research activity include education or education-related fields. The Task Force staff added the names of research and testing organizations which they regarded as potential sponsors of research training activities. This resulted in a list of 47 organizations included in the survey. (They are listed in Appendix L.)

Development of an Instrument

Having determined the categories of institutions to be surveyed, and having developed a list of institutions and organizations for each category, the Task Force staff next considered methods to identify the agencies which actually provide training opportunities in educational RDDE. It was clear from the number of organizations on the lists -- some 700 in all -- that a mail questionnaire would have to be employed. Considerations in developing a questionnaire were (a) to develop an instrument which would produce a good rate of response, and (b) to construct the instrument in such a way that it would elicit comparable information from all respondents.

The development of instruments for the survey divided logically into two parts. The institutions and organizations to be contacted were already separated into those which grant academic degrees and those which do not. It was expected that there would be little comparability between the kinds of training offered by the two groups. Generally, training programs in the first group would be longer in duration, would tend to have formal entrance requirements, and would be composed of a combination of course work, area examinations, practical experience and perhaps an original research project. In addition, certain standards of performance in each component would be required for completion of the program. Training activities of the non-degree granting organizations, on the other hand, would usually be short-term and would offer in addition to some lectures and seminars various workshops, institutes and conferences. These activities would be less likely to have the kinds of formal prerequisites that are necessary for entrance to an academic degree program. Such considerations, and differences in the kinds of information desired from institutions in the two categories, led to the development of two separate questionnaires.

The questionnaire for degree granting institutions. In constructing the questionnaire for colleges and universities (Q^1), the Task Force staff used three sources of information. First, the study of educational research programs conducted by David Krathwohl (1965) was reviewed. An attempt was made to obtain the questionnaire and the raw data used in the Krathwohl study; unfortunately, these were not available and a replication was therefore impossible. Secondly, the staff reviewed data collected for an earlier Task Force study of the 89 training programs established under Title IV of the Elementary and Secondary Education Act. Third, USOE was asked to indicate specific types of information considered appropriate for the directory of educational research training programs.

A draft questionnaire was constructed based on input from the outside sources and containing, in addition, a number of items written by the staff to solicit information not obtained in earlier studies. The draft was then submitted to associates of the Laboratory of Educational Research (LER) for their reaction. Following their criticisms and advice, the Task Force staff prepared a revised questionnaire to be submitted to USOE for approval. The suggestions of USOE personnel were incorporated into a final one-page (two sides) instrument used in this portion of the survey. The final questionnaire and cover letter are shown in Appendix M.

The questionnaire for non-degree granting organizations. Development of the questionnaire for non-degree granting institutions and organizations (Q^2) proceeded somewhat differently. At the beginning, the staff found that its conception of the kinds of training activity conducted by these groups was much less clear, and that there was less certainty about the kinds of information to seek from them. It was therefore decided to send a letter request to a number of the non-degree granting institutions in the list. The letter asked that the addressee supply information on any RDDE training activities of his organization and that he furnish the names of individuals within the organization who could be contacted for more detailed data. These letters, a sample of which appears in Appendix M, were sent to some 25 professional associations and private research organizations, to the director of each USOE R&D center and regional educational laboratory and to the research director of each state department of education. Replies were received from 74 of the 97 groups, some of which responded that they do offer educational RDDE training activities of some kind. The descriptive information furnished by the respondents was used by the Task Force staff in developing items for a draft questionnaire.

From this point on, the construction and approval of the instrument paralleled that of the questionnaire for degree granting institutions. The final questionnaire appears with its cover letter in Appendix M.

Distribution of the Questionnaires

On July 16, 1971, the first questionnaire (Q^1) was mailed to 478 degree granting institutions; 208 of these were doctoral institutions and 270 were institutions which grant the master's but not the doctorate. The questionnaires were addressed to the highest administrative officer (dean or chairman) of the college, department or school of education or (in the absence of an education unit) of the graduate school. By searching the Education Directory, the institutional catalogues, and miscellaneous sources, the Task Force staff was able to identify by name about 60 percent of the addressees. In these instances, the name of the addressee was typed on the envelope, along with his title and business address; the name was also handwritten at the top of the questionnaire cover letter. In cases where the individual's name was not known, the questionnaire envelope was addressed by title only.

In all instances, the mailing consisted of the questionnaire itself, the attached cover letter, and a return envelope, pre-stamped and pre-addressed to the Task Force office. Both the initial mailing and the return were by first-class mail.

The second questionnaire (Q^2) -- for non-degree granting institutions and organizations -- was mailed on August 5, 1971, to a total of 193 groups in the following categories:

1. State departments of education. Q^2 was not sent to those departments where the research director had answered our earlier inquiry by replying that his organization offered no training in research or research-related areas. (These are the starred entries on the list of state education departments in Appendix L.) Q^2 was sent to the research

director of each department which did not reply to our earlier inquiry. For departments which did reply to the initial inquiry by providing names of persons to contact for more detailed information, Q^2 was sent to those individuals. In all, Q^2 was sent to 54 individuals in 37 state education departments.

2. USOE-supported R&D centers and regional educational laboratories. Q^2 was sent to the director of each center and laboratory whether or not he had replied to the earlier letter request. There were 19 individuals in this mailing.

3. Regional education and school study councils. Q^2 was sent to all 82 members of the National School Development Council (see Appendix L). In all cases, the questionnaire was addressed to the director, executive secretary or president, as listed on the membership roster.[2]

4. Professional education associations. Q^2 was sent to the executive officers of three professional associations on the basis of replies to the initial letter of inquiry. (The associations not receiving Q^2 because they indicated that they had no RDDE training are starred on the list in Appendix L.)[3]

5. Private research and development organizations. Q^2 was sent to all organizations in this category which are listed in Appendix L except those three (starred) which replied negatively to the initial letter request. The questionnaires were addressed to the personnel training directors of the remaining 44 organizations.

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[2] The NSDC membership roster was kindly furnished by John W. Kohl, Executive Director of the organization.

[3] In addition, the Task Force staff already had information on the training activities of several other professional organizations, obtained for Technical Paper No. 11 in the Task Force series. This information was to be included in the training directory produced by the Task Force.

6. Federal agencies. Q^2 was sent to each of the eight Federal agency personnel suggested by USOE personnel (see Appendix L).

In all, then, Q^2 was sent to 210 individuals representing 193 separate non-degree granting institutions or agencies. As with Q^1, the mailing consisted of the questionnaire, the cover letter, and a pre-stamped, pre-addressed return envelope.

Follow-up Procedures

By August 9, the deadline indicated in the cover letter, replies to Q^1 had been received from 276 recipients of the questionnaire (58 percent). A follow-up letter was prepared and was mailed on August 13 to those institutions which had not replied at that time. The mailing included the follow-up letter (see Appendix M), another copy of the questionnaire, and another stamped, addressed return envelope. By the time of the cut-off date for replies (September 10), 129 additional institutions had responded, bringing the total number of respondents to 405 degree granting institutions (85 percent of the original recipients of the questionnaire).

For the 193 non-degree granting organizations, the indicated deadline was August 16, by which time 85 groups (44 percent) had replied. A follow-up letter was prepared (see Appendix M) and was mailed on August 26 to the Q^2 recipients who had not responded. This mailing also included another questionnaire and a stamped, addressed return envelope. An additional 56 institutions had responded by the September 17 cut-off date, bringing the total to 141 non-degree granting organizations (73 percent).

Nonrespondents

The 73 nonrespondents to Q^1 have the following characteristics:

1. Thirty-eight nonrespondents are master's degree granting institutions; 35 are doctoral institutions. The master's institutions represent 23 states; the doctoral institutions represent 20 states and districts. Among the master's nonrespondents, 14 of the 38 questionnaires (37 percent) were addressed to the dean of the school of education by name, rather than by title alone; for the doctoral nonrespondents, the ratio is 21 out of 35 (60 percent). It is interesting to note that 13 of the doctoral nonrespondents are institutions which, at one time, had educational research training programs funded under Title IV of the Elementary and Secondary Education Act.

2. Size of nonresponding institutions:

	Master's	Doctoral
Under 3,000	13 (34%)	3 (9%)
3,000 - 5,000	12 (32%)	3 (9%)
5,000 - 10,000	10 (26%)	11 (31%)
Over 10,000	3 (8%)	18 (51%)
	38 (100%)	35 (100%)

3. Affiliation of nonresponding institutions:

	Master's	Doctoral
State or local	25 (66%)	16 (46%)
Independent	7 (18%)	12 (34%)
Church-sponsored	6 (16%)	7 (20%)
	38 (100%)	35 (100%)

The 52 non-degree granting institutions and organizations which did not respond to Q^2 are distributed as follows:

6	State departments of education (16 percent of the 37 groups surveyed in this category)
3	R&D centers and laboratories (16 percent of the 19 groups surveyed)

27 Regional education councils (33 percent of the 82 groups surveyed)

14 Industrial research organizations (32 percent of the 44 groups surveyed)

2 Professional associations (67 percent of the 3 groups surveyed)

It is evident from the above findings that the most serious nonresponse problem was in industrial organizations and regional councils.

Findings

Degree Granting Institutions

Of the 405 degree granting institutions responding to Q^1, 91 indicated that they have formal training programs in educational research or research-related areas. Examination of the questionnaires, however, led the Task Force staff to exclude eight of these from consideration in the descriptive information which follows. It was clear from the information given by these eight respondents that they regard all of their students as educational research trainees, no matter what their field of specialization. Since this assumption runs counter to the stated definition of RDDE training, the staff deleted the eight responses.

The remaining 83 positive responses from institutions in 36 states are included in the following data; 12 are from institutions which offer the master's degree but not the doctorate; 71 are from institutions which offer the doctorate (though not necessarily in educational research). Thirty of the 83 positive responses are from institutions which have been included in the ESEA Title IV graduate research training program.

Of the 83 institutions represented, only 18 are not supported by public funds; 11 of those 18 are in Massachusetts, New York or Pennsylvania. The total student enrollment of the 83 institutions, as given in the 1969-70 Education Directory, is as follows:

Total Enrollment	Number of Institutions
< 3,000	2
3,000 - 5,000	7
5,000 - 10,000	15
10,000 - 20,000	33
> 20,000	26
	83

The following descriptive information is taken directly from the questionnaire responses of the 83 institutions. The number to the left of each heading corresponds to the item on the questionnaire. (Refer to Appendix M for the precise wording of each item.)

2. Number of years the program has been in existence

1 : 5
2 : 10
3 : 8
4 : 8
5 : 25
6 : 7
7 : 3
8 : 4
9 : 1
10 : 1
> 10 : 6
no response : 5
(N = 83)

3. Degrees offered in the educational RDDE program

M.A.: 29
M.S.: 20
M.Ed.: 25
Ed.D.: 28
Ph.D.: 48
Other: 12[5]
(N = 83)[4]

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[4] The number of degrees listed exceeds 83 since many institutions offer more than one type of degree in educational RDDE.

[5] "Other" includes Education Specialist (4), Advanced Certificate (2), Professional Diploma (2), MAT (1), DA (1), Post-Master's Diploma (1), and Research Minor (1).

For those institutions which offer the doctorate:

1 offers the D.A. only
6 offer the Ed.D. only
26 offer the Ph.D. only
22 offer both the Ed.D. and Ph.D.
55

Overall, the 83 research training programs may be categorized as follows:

28 less than the doctorate
18 doctorate only
35 doctorate plus master's
2 doctorate plus other
83

4. Number of students in educational RDDE

Less than doctoral level:		
	Full time	340
	Part time	367
Doctoral level:		
	Full time	656
	Part time	397

5. Criteria for admission to the educational RDDE program

Graduate Record Examination (GRE)

GRE scores are considered of primary importance by 37 programs. For the 29 which indicated desired minimum scores, the ranges and medians are:

GRE Total:	range 900-1300, median 1000
GRE Verbal:	range 450-600, median 500
GRE Quantitative:	range 450-650, median 550

An additional 26 programs consider GRE scores of secondary importance for admission; the minimum scores indicated for these programs have a somewhat lower median.

Two points should be made regarding the information on GRE scores as criteria for admission. First, several institutions which consider the verbal score and the total score of secondary importance regard the quantitative score as a primary admissions indicator. Second, many programs stress that the minimum scores which they listed should be considered as indicators of the desired level, rather than as absolute cut-off points for admission.

Miller Analogies Test (MAT)

The MAT is of primary importance for 19 programs and of secondary importance for 21. For those listing minimum desirable scores, the range of raw scores is 50-70 and the median is 55.

Other Standardized Tests

Only 13 programs listed other tests as criteria for admission. The tests listed are the National Teachers Examination (3), the Advanced GRE in Education (3), the Terman Concept Mastery Test (2), the Watson-Glaser (2), Coop English Test (2), the STEP Writing Test (1), the Doppelt Test of Mathematical Reasoning (1), and SCAT (1).

Grade Point Averages (GPA)

The undergraduate grade point average is of primary importance for admission to 54 programs. For the 48 which listed a generally required minimum, the median GPA was 3.0 on a 4-point scale. An additional 20 programs consider the undergraduate GPA of secondary importance. It should be noted that the minimum GPA required was often qualified as applying to the last two years of undergraduate work.

Forty-six programs consider the graduate GPA of primary importance and 38 of these indicated a required minimum (median graduate GPA 3.3 on a 4-point scale). Another 17 regard the graduate GPA as secondary in importance.

It should be noted here, as in the paragraphs above on GRE scores, that the listed minimum grade point averages are regarded as indicators of admissibility and not as absolute standards for admission.

Previous Course Work

Previous course work in particular areas is of primary importance for 22 programs and of secondary importance for 24. The courses listed are categorized as follows: 32 in mathematics, statistics, or other quantitative work; 24 in psychology; 12 in education. (The total is greater than the number of programs responding since some respondents listed more than one area of desired course work.)

Undergraduate Major

Undergraduate major is of primary or secondary importance for 14 programs. The desired majors are: 10 psychology, 9 mathematics, 5 education. (The total is greater than 14 since some respondents listed more than one major.)

Recommendations, Experience, Interview, Interest, Age

Responses to the remaining six categories of admission criteria are as follows:

	Primary Importance	Secondary Importance	No Importance or Blank
Recommendations	40	34	9
Research Experience	8	45	30
School Experience	13	37	33
Interview	35	23	25
Stated Interest in Research	65	12	6
Age	5	28	50

6. Minimum registration requirements

The responses to item 6 of the questionnaire were collated to produce the information which follows. Nearly all respondents indicated that part-time students are accepted in the research training program; only four stated that they have no part-time students. For the 79 institutions accepting part-time students, the minimum number of credit hours required per academic term is given below.

Credit Hours Required Per Academic Term	Number of Programs
1 to 3	34
4 or 5	10
6 to 8	11
9 or more	11
no minimum	13
	79

It should be pointed out that, in most cases, nine or more credit hours per term is equivalent to full-time registration. Therefore it is probably more accurate to say that 68 programs -- rather than 79 -- accept part-time students, and that 15 do not.

In terms of the minimum number of courses required per term, 37 programs require one course, 10 require two courses, and 7 require three or four. (Since several respondents indicated a minimum number of hours but not a minimum number of courses, the total here does not agree with that above.) Again, three or four courses per term is essentially a full-time requirement.

Of the 83 institutions responding, 24 operate on the quarter system, 54 on the semester system, and 1 on trimesters; 4 institutions left the item blank.

7. Minimum period of full-time residence required

All except 3 of the 55 programs which offer the doctorate require full-time registration of their students for some period of time.

Minimum Period of Full-time Registration	Number of Doctoral Programs
less than 1 year	2
1 year	42
2 years	8

For the 28 sub-doctoral programs, on the other hand, only 5 require some period of full-time registration. Four of these specify one full-time semester; the fifth requires three full-time quarters.

8. Areas of emphasis in RDDE training programs

The areas of emphasis of the 83 RDDE training programs are listed below. Since most programs indicated more than one area, the total is much greater than 83.

Area of Emphasis	Number of Programs
Research methodology/design/statistics	71
Measurement	51
Evaluation	47
Psychology	22
Curriculum and instruction	16
Administration	12
Counseling and guidance	6
Education subject areas[6]	6
History and philosophy of education	3
Vocational education	1
Special education	1
Educational product or program development	10
Dissemination and diffusion	4
Other[7]	9

It should be noted that in item 8 on the questionnaire the respondent was asked to indicate those areas in which "researchers and research-related personnel" are being prepared. The above listing may thus be taken to indicate, for example, that 12 institutions offer training in research in administration, and that 6 programs emphasize research in counseling and guidance.

Although it is not evident from the figures above, it is interesting to note that nearly half the programs (39 out of 83) indicate research methodology, measurement, or evalution as their only major areas of emphasis. An additional ten programs focus on one or more of those three areas plus psychology. Thus, only 34 of the 83 programs have one or more RDDE specializations outside the areas of research methodology, measurement, evaluation, and psychology.

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[6] Subject areas include reading, science, mathematics, social studies, English, foreign languages.

[7] "Other" includes computer science, urban schools, policy studies.

9. Course requirements

There is great variation in both the number and kind of course requirements among the responding institutions. The responses to this item for master's and doctoral programs are given below. (It should be noted that several institutions responded only by checking the areas in which courses are required, rather than by indicating the number of required courses in each area. In these cases, the institution was recorded as requiring one course in the indicated area.)

TABLE 19

Course Requirements in Educational RDDE Programs

Area	Number of Courses Required					
	Master's Programs			Doctoral Programs		
	1	2	3+	1	2	3+
Introduction to educational research	46	3	0	33	3	1
Advanced research methods	27	3	0	24	20	5
Statistics	27	20	6	13	8	32
Computer methods and use	20	3	1	25	8	3
Testing (use of standardized tests)	32	3	2	22	7	0
Measurement and test construction	30	4	0	25	11	3
Evaluation	15	0	0	23	3	0
Curriculum and instruction	14	2	2	16	3	2
Administration	3	0	1	5	1	2
Research management	2	0	0	9	1	0
Communications	1	0	0	2	0	0
Marketing	0	0	0	1	0	0
Politics/finance of education	0	0	0	3	2	0
Educational change	1	0	0	11	0	1
Product development	1	0	1	2	0	1
Instructional sequencing	5	2	0	5	4	0
Psychology (including educational psychology)	18	6	7	11	4	13
Sociology	6	0	0	8	0	0
History/philosophy of education	25	1	1	18	3	1
Other[a]	3	0	0	2	1	1

[a] "Other" includes planning, urban studies, philosophy of science, learning in the affective domain, research in related disciplines.

10. Practical research experience required

Of the 83 institutions responding positively to the questionnaire, 46 require at least one of the kinds of practical experience listed in item 10. Thirteen of these represent programs which do not offer the doctorate; 33 represent programs which do offer the doctorate. The total responses are as follows (some programs require more than one kind of research experience):

Type of Experience Required[8]	Number of Programs
Assistantship or internship within the program:	
Across several projects	13
On a particular project	16
Assistantship or internship in a campus research unit outside the program:	
Across several projects	2
On a particular project	7
Assistantship or internship off campus[9]	8
Apprenticeship to a senior researcher	10
Technical consultant services	7

Non-Degree Granting Organizations

Of the 141 non-degree granting institutions and organizations which responded to Q^2, a total of 55 indicated that they offer RDDE training activities which fit the definitions given in the questionnaire. The 55 organizations are in the following categories:

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[8] An additional nine programs require one or more of the above kinds of experience, but the type was not specified. These nine programs are included in the total of 46.

[9] Usually in a school setting or educational research office.

19	State departments of education
9	USOE-supported R&D centers and laboratories
19	Regional education and school study councils
7	Private research and development organizations
1	Federal agency
55	

Because of the great variety of training activities in educational research and research-related areas which are conducted by the 55 organizations and because of the lack of uniformity in responses, it is not possible to give precise data for each of the questionnaire items. The following is rather an attempt to present, in narrative form, a summary description of training activities for each category of organizations. For the purposes of this description, the activities of the one Federal office -- a USOE bureau -- will be combined with those of the R&D centers and laboratories.

State departments of education. The most common vehicles for research training among the 19 education departments are workshops and conferences of one to two days' duration. The frequency of the training activities varies from monthly to annually, with nine state departments of education offering only annual programs.

About one-third of the departments restrict participation to their own employees and another third permit limited outside participation (by teachers, principals and school superintendents, for example). The remaining programs are open to anyone interested. Only one education department charges a fee for participation, and that is minimal ($2.50 for registration). Three respondents indicated that support for their programs comes from USOE funds.

Nearly all of the education departments use their own staff as instructors in some of their training activities. About half also use persons outside the organization.

Regarding major objectives of the organization in providing training opportunities, four options were presented in the questionnaire: (a) presenting information on new developments, (b) raising job aspirations of staff members, (c) updating knowledge in subjects previously studied, and (d) giving in-depth training in new subjects. The major objectives of the 19 state education departments are divided about equally among these four.

Nine of the responding education departments have formal internship arrangements with colleges and universities. Ten allow staff members time off with pay to take credit courses in an academic institution; only four pay the employee's tuition for such courses.

A total of 55 topics for training seminars, workshops, institutes and the like -- held over the past year or planned for the coming year -- were listed by the 19 organizations. They have been combined into five areas, as follows:

Topic Area	Number of Times Listed
Evaluation	27
Management, including PPBS	11
Proposal development	7
Dissemination	6
Other*	4

*Statistical analysis, curriculum innovation, project development, data processing.

R&D Centers, regional laboratories, USOE bureau. Most of the 10 organizations in this category hold one- to three-day seminars or workshops, some monthly or quarterly and some annually. One laboratory conducts an annual seminar of one to two weeks duration and an annual workshop one to four weeks in length. Another has two conferences per year, each three to four weeks long. One of the centers conducts a six-week institute three times a year.

Two organizations restrict participation to their own employees and two others allow participation by anyone interested. The remaining six accept limited outside participants. Two of the R&D centers charge fees for their training activities ($10 and $25). Another indicates that tuition is charged for those training activities which earn graduate credit at a participating academic institution.

Seven of the groups use only their own staff as instructors in the training program. The other three use outside instructors as well.

Seven respondents indicated that the major objective of their programs is to provide in-depth training in subjects new to the participants.

One stated that the training objective is to allow the organization's constituents to participate in educational development.

Six of the labs and R&D centers have internship programs with colleges and universities. Eight allow their employees time off with pay for course work and four of these also pay tuition.

The 31 training topics listed by respondents in this group -- from activities held in the past year or planned for the coming year -- are categorized as follows:

Topic Area	Number of Times Listed
Evaluation	13
Product or program development	6
Dissemination	3
Management	3
Change theory and strategies	3
Other*	3
	31

*R&D process, proposal writing, problems of Appalachian education.

Regional education and school study councils. The most common training vehicles of the 19 regional councils are again workshops, seminars and conferences, lasting from one to five days and occurring monthly, quarterly, semi-annually or annually. In addition, one group conducts an annual ten-day institute and another holds two-week workshops continually throughout the year. In general, training activities sponsored by the regional councils are open to limited outside participants.

Eight groups charge no fees for participation in their training programs; the average charged by the remaining eleven groups ranges from $5 to $60, with a median of $25.

Nearly all of the groups draw their instructional staff from both inside and outside the organization. About half the respondents from regional councils indicated that the major objective of their training programs is to inform participants of new developments in their fields. The other organizations regard in-depth training in new subjects as their primary objective. Nine of the councils have formal internship arrangements with colleges and universities.

Ten organizations indicated that their employees are given time off with pay to attend courses in a college or university; of these, seven pay tuition for courses taken by employees.

The 43 research-related training topics listed by regional council respondents have been combined into the 6 categories below. It should be pointed out that many respondents also listed in this item such topics as student unrest, drug abuse, human relations, and health and safety. Since these are not considered to be educational research-related topics, according to the Task Force definitions, they are not included in this listing.

Topic Area	Number of Times Listed
Evaluation	20
Management, including PPBS	9
Proposal development	3
Dissemination	2
Curriculum and instruction	2
Other*	7
	43

*Research design and techniques, research in reading, R&D for Appalachian schools, statistical methods.

Private research and development organizations. About half of the seven private research organizations have training programs which include workshops and seminars lasting for one to five days. Activities of greater duration are offered by three groups: one conducts one- to two-week workshops three times a year; the others have annual institutes of two to four weeks and two to three months, respectively.

With one exception, training activities of these groups are open to those outside the organization. Five organizations charge no fees unless college credit is earned; then tuition is paid to the academic institution. Another charges an average fee of only $2 per person. The remaining organization has fees ranging from $350 to $650. Most respondents indicated that funding for the training programs comes from the organization itself.

Four of the organizations use only their own staff members as training instructors. The other three use outside persons as well. All but one of the respondents indicated that the objective of the training program is to inform participants of new developments in their field or to update their training in subjects they have already studied.

Four of the private R&D organizations have either formal or informal internship arrangements with colleges and universities; three do not. Four groups neither pay tuition nor give time off with pay for college or university courses taken by employees. Three groups do give time off with pay and two of these also pay tuition.

The 16 topics for training activities conducted by private R&D organizations in the past year or planned for the coming year have been combined into the 6 categories below.

Topic Area	Number of Times Listed
Research design, programming and evaluation	2
Product and program development	4
Dissemination	2
Evaluation	3
Measurement	4
Statistics	1
	16

Discussion

The information gathered in the course of this study -- from 83 degree granting institutions and 55 other organizations and agencies -- has been used to compile a directory of training opportunities in educational research and research-related areas. (The directory appears as a separately bound appendix to this report.) It is the hope of the Task Force that this directory will serve as a valuable guide to those individuals who seek such training and as a source of information to those groups concerned with expanding and improving educational RDDE training in the United States. The following summary and discussion of some of the findings may be of benefit.

Among the 83 educational research programs in colleges and universities, only 18 are located in non-public institutions; nearly three-fourths are in institutions with student enrollments over 10,000. With the exception of 1966-67, between five and ten new training programs have been started each year for the past six years. The much larger number for 1966-67 reflects the impetus of the ESEA Title IV research training provisions; 14 of the 25 programs begun in that year are in institutions which received Title IV funds.

Although the M.Ed. and Ed.D. are generally not considered research degrees, a sizable number of programs offer these degrees in educational research (25 and 28 programs, respectively). The Ph.D., however, is by far the more common of the two doctoral degrees, with 48 programs offering the Ph.D. compared to 28 for the Ed.D. It is interesting to note that fully one-third of the 83 programs do not offer any doctoral degree, but concentrate instead on master's level and education specialist training in educational research.

Nearly all of the doctoral training programs (50 out of 55) require at least one year of full-time residence for completion of the degree. The great majority of sub-doctoral programs, on the other hand, require no full-time registration of their students.

Sixty percent of the doctoral programs require formal practical research experience of their graduates, compared to slightly under half of the sub-doctoral programs. The kind of experience most heavily favored is an assistantship or internship on one or more projects within the graduate program itself. Only ten programs require formal apprenticeship to a senior researcher.

At the end of the 1970-71 academic year, over 700 sub-doctoral students were enrolled in educational RDDE programs, about half of whom were studying full time; over 60 percent of the more than 1000 doctoral students were engaged in full-time study. In discussing the Title IV graduate research training programs, Clark and Hopkins (1969, p. 305) indicated that about one-half of the full-time sub-doctoral students and one-third of the full-time doctoral students could be expected to receive their degree each year. If the same assumption is applied to the registration figures obtained in this study -- and if it is assumed further that most students complete their program and enrollment figures will not decline substantially -- then the existing educational research programs are producing between 350 and 400 graduates each year from their full-time students alone.

In terms of areas of emphasis, the graduate programs in this study focus overwhelmingly on research methodology, measurement and evaluation. Only a handful of programs place major emphasis on educational development or dissemination and diffusion.

The same is true, to a very large degree, of the 55 non-degree granting organizations which regularly offer research-related training. Evaluation is by far the area of greatest interest, as indicated in the workshop, seminar, institute and conference topics listed by the respondents. This is true not only in state education departments, where ESEA Title I and Title III evaluation requirements must be met, but also in R&D centers and laboratories and in the regional education councils. The areas of management, development and dissemination fall well behind in the topics listed.

Somewhat more than half of the non-degree granting organizations consider the major focus of their training program to be the updating of earlier training rather than in-depth instruction in areas new to the participants. The lack of emphasis on in-depth training is probably also reflected in the fact that only eight of the fifty-five responding organizations have regular training activities of more than five days duration. It is also true that over half of the organizations, through internship arrangements with colleges and universities, provide opportunities for practical experience in educational research and research-related areas. This underscores the apparent role of the non-degree granting organizations as facilitators -- rather than major instigators -- of research-related training.

Since the major purpose of the effort reported in this chapter was to gather information for the directory of training opportunities, it was not anticipated that the data which have been described would yield any major conclusions. Nevertheless, three very general comments seem appropriate. First, the colleges and universities are preparing a respectable number of students in research methods and design, measurement and evaluation. Second, other organizations conduct training activities in response to the felt need of their staff and clients; at present, the major need for such training seems to be in the area of educational evaluation. It may be that universities and colleges need still more emphasis on training in this area. Last, among the groups surveyed there appears to be no major effort underway for the training of educational developers and disseminators.

CHAPTER VI

AN UPDATING OF THE CLARK-HOPKINS MANPOWER PROJECTIONS

AN UPDATING OF THE CLARK-HOPKINS MANPOWER PROJECTIONS[1]

Purpose of the Study

Educational research training programs have as their major purpose the production of trained personnel to carry out research and research-related activities in education. One could argue that training program directors have an obligation to both the existing research community and its prospective members to keep informed of the size of the research community so that neither jobs go unfilled nor people go unemployed. The most effective use of manpower would occur if precisely enough personnel were trained in educational research, development, diffusion, and evaluation (RDDE) to fill existing job openings. This is not at all practical, however, because the educational system is constantly changing, resulting in sometimes drastic reductions or increases in the need for trained personnel. To be prepared for those changes, it is necessary to make projections--informed estimates (based, it is hoped, on valid and reliable data) of where the profession is heading.

Such a projection was made in 1969 by David L. Clark and John E. Hopkins in A Report on Educational Research, Development, and Diffusion Manpower, 1964-1974 (Clark and Hopkins, 1969). Since that time, economic and political shifts have occurred which make the projection overly optimistic. Because of those shifts, the AERA Task Force felt it necessary to update the earlier projection to make it conform more closely to reality. Thus, one of the objectives of this year's Task Force activities was: "To revise existing manpower projections based on recent funding of RDDE activities" (sub-objective 5.1). It was found that the

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[1] This chapter, which appeared earlier as Technical Paper No. 25 in the Task Force series, was prepared by Dr. John E. Hopkins of Indiana University.

Clark-Hopkins projection was the most comprehensive--indeed the only financially-based--projection of the demand for trained personnel in educational RDDE. Therefore, this chapter is an updating of the projection made in the 1969 report based on actual funding through 1971 and current administrative feelings on the future of RDDE activities through 1974.

Very briefly, the procedures used in the 1969 Clark-Hopkins report were the following. Basic data regarding personnel supported in RDD positions were obtained from those FY 1966 proposals which had been approved for funding. Financial data (appropriations, expenditures) were available through FY 1968, in most cases. Program administrators in eight USOE divisions and one NSF program were interviewed to obtain their perceptions of the growth of their program through FY 1974. Using this data base and logically derived extensions of the data, three projections were made of anticipated funding in FY 1974: a least optimistic one, a most optimistic one, and a most likely one. Financial projections were transformed into personnel projections through the use of a "growth ratio," the amount of money projected for 1974 (taking into account inflationary trends) divided by the amount of money actually available to support a given number of people in 1968. If the growth ratio was one, exactly the same number of people could be supported in 1974 as were supported in 1968. Personnel demand was projected along three dimensions: institutional setting, professional assignment, and RDD function.

The manpower projections in the 1969 Clark-Hopkins report have several limitations. These include the following:

1. When the original data were gathered, evaluation personnel were not identified as a separate group as were research, development, and diffusion personnel. There is no projection, therefore, of the demand for or influence of this visible and important group.

2. The heady atmosphere which prevailed after passage of the Elementary and Secondary Education Act (ESEA) in 1965 resulted in some of the original projections being so optimistic that they bear little relationship to the current situation.

3. The projections were based on the number and type of positions listed in the budgets of funded proposals, on the assumption that the project directors would actually employ the number and type of personnel cited in their budgets. No follow-up was made, however, to determine what personnel were actually employed to carry out the projects and thus to determine the validity of the assumption.

4. The possibility of retraining professionals from fields other than education to meet the supply deficit in education was not fully examined.

A full replication of the original study would have been necessary to remedy the first of the above limitations. A new study would be needed to examine fully the fourth item.[2] Neither the time nor the money available to complete objective 5.1 would permit this. The present chapter does attempt to remedy the second and third items above by:

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[2] An argument against retraining as a major source of supply is presented as Appendix N to this report.

1. updating the projections of demand for trained educational research, development, diffusion, and evaluation (RDDE) personnel in 1974, based on the current economic situation;
2. examining the possibility that there were significant discrepancies between number and type of positions listed in the budgets of funded proposals and the number and type of persons who were actually employed to carry out the projects or programs.

Significance of the Study

Trainers, training program administrators, and students who are prospective educational RDDE professionals have a very practical need to know the range of possibilities with respect to the future demand for and employment of educational RDDE personnel. The necessity for having data to support the sensible allocation of human resources appears to be justification enough for carrying out such a study.

The justification need not be quite so narrow, however. Policy makers and manpower specialists generally have taken the position that the trend of events in this country is leading toward an expanded demand for persons who can help to improve the quality of life in the United States. For example, the authors of a recent manpower study concluded the rate of production of Ph.D.'s should be reduced, but only in those fields where there was an oversupply, e.g., the mathematical sciences, the physical sciences, and engineering. The supply of trained persons in the life sciences and applied social sciences was said to be "critically short," and the authors recommended the supply of Ph.D.'s in these areas be increased (Dean, et al., 1971, p. 4).

More directly, in a survey supported by Phi Delta Kappa, the deans of the doctorate-producing schools of education in the country responded that "the most critically needed program expansion(s) or program development(s) in the field of education at this time" was "educational research" (Robertson and Sistler, 1971, p. 63).[3]

The authors of the PDK study note their belief that the deans were not necessarily indicating that expansion of conventional educational research programs was needed. Instead, the authors believe the administrators were saying expanded training was most critically needed in the areas commonly referred to as educational research and evaluation and development and diffusion.

When the range and variety of alternatives to our present public schools--which are already being tested--are considered (e.g., voucher systems, performance contracts, freedom schools, community-controlled schools), together with the pressures which are being brought more heavily to bear on schools (e.g., integration, drug and sex education, economic and educational accountability), it is easy to agree with the deans that in the next several years the schools will most need the help of a corps of "field engineers," so to speak. Educational RDDE personnel are viewed here as fulfilling that function. It goes without saying that the effectiveness of these educational RDDE personnel will be contingent upon their training--and the training to work in such a complex milieu takes time. That time will be available only if there is advance planning and programming. This study will serve as an aid to those who must do the planning and programming.

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[3] Three other areas named near the top of the list were urban education, early childhood education, and junior and community college education.

Limitations of the Study

From the outset, this study had two very specific objectives: (1) to update (not replicate) the projections of demand made in the original study by Clark and Hopkins, and (2) to test the validity of the assumption that the number and type of positions listed in the budgets of approved proposals would lead to the employment of that number and type of personnel.

These objectives imposed a series of limitations on the study:

1. Without a re-examination of the basic data sources, any updated projections of the type of positions available in 1974 would necessarily be limited to research, development, and diffusion positions. Rather than tend to perpetuate the impression that evaluation and evaluators do not compose an important segment of the educational RDDE community, it was decided not to prepare a projection of the types of position to be available in 1974.[4]

2. No attention could be given to programs which had been initiated since the data for the original study were gathered in May 1966. Hence, nothing could be included here on such efforts of the Office of Education as the experimental schools project, the Anacostia project, the various undertakings in reading, and so forth. On the

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[4] [Editor's note] It is not possible, with the data gathered for this study, to differentiate among the functions of RDDE. If one is willing to accept the proportions projected in the original study, however, as still being the likely trend, then those proportions (research: 33%, development: 50%, diffusion: 17%) may be applied to the projected total number of positions presented later in this chapter (Clark and Hopkins, 1969, p. 288).

other hand, on the surface it does not appear that these programs will employ such large numbers of RDDE personnel that the failure to include them seriously compromises the projection of the present study.

3. It was not possible to examine recent proposals to determine whether there had been a change in the number or type of persons being supported by the various programs; consequently, the original ratios of people to dollars expended were used in updating the projections.

4. There was no possibility of examining the means by which the demand for personnel in FY '66-'68 was satisfied, or the means by which the initial and/or in-service training of the people who moved into the field at that time was conducted.

In addition, events and circumstances have created another set of conditions which has produced limitations in the present study. These are:

1. There are now so many unknowns in the program administrators' environment that, for the most part, they were either unable or unwilling to project the course of their programs even a few years into the future. Their uncertainties about the effect of a National Institute for Education (if there is one), the health of the national economy, national priorities, and similar matters have produced a situation where only two of the administrators interviewed would state in specific terms where he was projecting his program to be by 1974. All of the others used such non-specific statements as "The program probably won't grow ve.y much."

This was a remarkable change from 1966, when many of the same administrators were willing to project eight years into the future rather than two or three years. One effect of the administrators' unwillingness to be specific is that there is no basis for preparing a multiple set of projections which encompass the likely range of possibilities. Therefore, unlike the original study (where there were three projections: Most Optimistic, Least Optimistic, and Most Likely), just one projection has been produced.[5] Another effect of their non-specificity is that the present writer has had to assign many more values arbitrarily than was true in the original study. These arbitrary assignments will be identified.

2. Some of the programs examined in 1966 have since modified their direction, emphases, implementation vehicles, and sources of control. Without an examination of recent proposals, it was necessary to use the original data to make overall projections, but the program changes made it seem unwise to use the original data to prepare refined projections of the spread of positions across the range of institutional settings.

3. Some of the funds included in the original study have since been re-allocated to support programs not included here (e.g., $12 million for the support of the experimental schools project).[6] Since

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[5] It is likely there would not have been much spread if multiple projections had been prepared because FY '74 is now so near that the opportunity for divergence is greatly reduced.

[6] It would not be accurate to say the experimental school monies "came out of" the funds used to support project R&D, for example, because there is no carry-over commitment to any program from one year to the next. However, there was a distinct decline in the funds made available for support of project R&D when the funds were awarded to start the experimental schools project.

the new programs are not included here, the projections of the original study and this updated version are based on differing dollar bases, hence the results of the two studies are not entirely comparable. The updated projections rest on a dollar base which is approximately four-fifths the size of the base for the original projections. However, this smaller dollar base seems more defensible.

4. There is little doubt that the heavy infusions of funds from the ESEA of 1965 produced an enthusiasm which caused the original projections to be unduly optimistic. However, the extended financial starvation of the R and D programs since that time appears to have caused the program planners now to become unduly pessimistic in their views of the future. This pessimism is reflected in the projection, since it represents the views of the men who run the programs, but the reader is alerted that this may result in the projection being somewhat lower than is warranted.

Description of the Methodology

The projection. A technical discussion of the projection methodology can be found in chapter three of the Clark and Hopkins report. The procedures followed to update the original projections were as follows:

1. Program administrators were interviewed to obtain (a) data on expenditures for the period FY '69-'71, (b) information on their FY '72 allocations, and (c) projections of the growth of their programs during FY '73 and '74. Information was also sought on the progress of the various sub-units in their programs which were used as part of the original projections (e.g., the number and growth of R and D centers, the progress of the educational laboratory program, the phase-out schedule for discontinued units).

2. The financial and program information received was broken into the same sub-units as were used in the original study. [There was one exception, which will be discussed in Table 20.]

3. As in the original study, the projected FY '74 amount was compared with the equivalent of the FY '68 dollars and an indicator of true growth obtained.[7] (See Table 55 on pp. 229-230 of the Clark-Hopkins report.) For example, the FY '74 equivalent of the FY '68 funding base of $1 million, after five percent per year is added to offset increases in costs, is $1,477,000. A program with just such a funding history would be assigned a "growth ratio" of 1.0.

4. The growth ratio was then applied to the base number of positions available in each of the sub-units (e.g., in the R and D centers, in the ERIC clearing houses, etc.). These base numbers are presented in Table 56 of the original study (p. 237). This produced the number of positions the projected FY '74 funds would support, assuming it would take about the same number of equivalent dollars[8] to support each position.

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[7] A five percent per year (to FY '74) increase was applied to all funding figures to provide "no real gain" figures. This "no real gain" projection was made "in order to determine the equivalent funding base needed in FY '74 to support the same number of people as were supported in FY '66" (Clark and Hopkins, 1969, p. 140).

[8] The term "equivalent dollars" is used to refer to the five percent per year increase in funds from FY '68 to FY '74. In the example given in No. 3 above, the $1,477,000 in FY '74 are "equivalent dollars" to the $1,000,000 in FY '68.

5. The total number of positions projected to be supported by USOE and the NSF course content improvement programs in FY '74 was considered to be a baseline number of RDDE positions to be available. There were entire populations of positions not yet represented (e.g., schools of education, business and industry). The next step was to go through the original study and itemize each of these populations and add them, or an appropriate proportion of them, to the baseline projection. This produced the final projection of the study.

The follow-up study of persons employed. Follow-up information on actual employment was sought from directors of a sample of the projects and programs included in the original study. The procedures followed were the following:

1. A list was compiled of the numbers and institutional locations of all of the projects included in the original Clark and Hopkins study.

2. A search was made of ERIC and the NCERD budget office's records for the name(s) of the princial investigator(s) of each project.

3. Membership directories (e.g., APA, AERA) and the National Faculty Directory were searched for current addresses for the investigators listed.

4. The projects were then arranged by USOE support programs (e.g., Higher Education Research, Elementary and Secondary Research) and, using a table of random numbers, a 20 percent sample of projects was selected from each program (with the one stipulation that no program was represented by fewer than five projects).

5. An initial letter of inquiry was sent to investigators May 28, 1971; a follow-up letter sent to non-respondents on June 25; and, finally, a postcard sent to those who had still not responded as of July 14.

6. The responses received were then separated into (a) projects where there had been changes in the persons employed from the persons listed in the budget of the original proposal, and (b) projects in which there had been no such changes.

7. The projects in which there had been changes were then further separated according to whether the changes appeared to have or not have significance for the original and current manpower projections. The analysis simply reports the degree and level of the changes reported by the principal investigators.

Presentation of the Data

The point was made in the original Clark and Hopkins study that the reader should focus chiefly on the magnitude of the difference in the positions available over time, rather than upon the specific number of positions said to be available or the precise difference. That point bears repeating here. The projected numbers are imaginary. They are used only to indicate to program planners, administrators, and directors the direction and scope for which they should develop contingency plans.

What follows is a projection of the positions which could be supported if the anticipated funds are, in fact, made available and the anticipated developments do occur. It is not a prediction of the 1974 situation; neither is it a forecast. The value of the original projections was that a concerned individual could readily check the developments which occurred after the projections were developed and could then revise them accordingly--in a much shorter period of time than it would have taken to develop a current projection from scratch. The present projection is a demonstration of the utility of the methods used. Obviously, however, the current projection is not as extensive as were the projections in the original study. The new projection is simply and solely an update, based on the best evidence obtainable, for the benefit of persons interested in the approximate magnitude of growth of the educational RDDE community.

Baseline projection. The baseline projection of this study, i.e., the projection of positions to be supported in FY '74 by selected USOE and NSF funding programs, is presented in Table 20. Since the baseline projection fails to account for large numbers of positions which have other sources of support (e.g., state and local governments, public schools, universities), additional populations are added later to get the final projection of the study with respect to the number of positions to be available in educational RDDE in FY '74.

The FY '74 projected funding figures were derived as follows:

1. R and D centers, early childhood centers, policy study centers, and laboratories--the program administrator furnished generalized projections into FY '73; the writer arbitrarily assigned a value for these programs in FY '74, using the funding history of these programs FY '66-'71 and the program administrator's FY '72 and '73 projections as guides.

Table 20

Equivalent Funding Base, Projected Funding, Growth Ratio, Base Number of Positions, and Projected Number of Positions, by Sub-Units ($ in Thousands)

Sub-Units	Equivalent Funding Base, FY '74	Projected Funding FY '74	Growth Ratio	Base Number of Positions	Projected Number of Positions
R and D Centers	$ 10,033	$ 9,250	.92	334	307
Vocational Education R and D Centers	1,477	3,350	2.26	39	88
Early Childhood Centers	2,277	1,585	.69	56	39
Handicapped Children and Youth R and D Centers	631	4,000[a]	6.33	20	127
Policy Study Centers	1,339	925	.69	19	13
Handicapped Children and Youth Materials Centers	1,477	4,200[a]	2.84	68	193
Laboratories	11,856	23,500	1.98	285	564
Clearing Houses	2,277	4,200	1.84	98	180
Vocational Education Research Coordinating Units	3,179	2,500	.78	227	177
State Education Agency Research Units	1,125	2,826[b]	2.51	144	361
Small Projects	3,431	3,000[a]	.87	407	354
Regular Projects[d]	62,126	39,568	.63	1,573	991

(Continued)

Table 20 (Continued)

Sub-Units	Equivalent Funding Base, FY '74	Projected Funding FY '74	Growth Ratio	Base Number of Positions	Projected Number of Positions
Title III Centers	8,865	8,774[c]	.98	479	469
NSF Course Content Projects	15,350	6,500	.42	514	216
TOTAL	$125,443	$114,178	1.70	4,263	4,079

[a] Administrators' estimates; all others are assigned values.

[b] Ten percent of the projected appropriation under Title V of the ESEA, as in the original study.

[c] Six percent of the projected appropriation under Title III of the ESEA, as in the original study.

[d] This is the one exception made to presenting the data broken into the same sub-units as were used in the original study. Previously, there was a separate sub-unit called "Special projects." The administration and management of RDD projects have changed since the original study, and now "Special projects" are in the same category as "Regular projects." Funding for "Special projects" has been incorporated into the "Regular projects" funding figures in this table.

2. Vocational education R and D centers--according to a member of the program staff, these centers are to be raised to their full funding level of $3.3 million (combined) in FY '72-'73 and held there, with only tiny additions of funds to offset inflationary inroads. The writer arbitrarily added $50,000 for FY '74, as a "tiny addition."

3. Handicapped children and youth R and D centers and materials centers--the projected figures are the administrator's projections.

4. ERIC clearing houses--the program administrator furnished generalized projections into FY '72; the writer extended his projections into FY '74 using the same guides as indicated in the first category above.

5. Vocational education research coordinating units (RCU's)--funds for the RCU's are no longer administered by the USOE, but are sent directly to the states where they are used to support training programs, R and D, and a wide variety of other activities. In FY '69 the states received approximately $2,270,000 from USOE for support of the RCU's. In FY '71, the Congress granted the states $17,874,000 for RCU support. No one was willing (or able) to project (a) what Congress would decide in the future regarding RCU support, or (b) what proportion of the funds granted would be used by the states to support RDDE positions. After considering the availability of qualified personnel and the behavior of RCU administrators in the past, one staff member very familiar with the program estimated a 10 percent expansion in the number of RDDE positions which could be supported to FY '74. The writer used this projection to assign a value of $2,500,000 of RCU funds to be used in FY '74 for educational RDDE as defined in the original study.

6. State department research units--funds for this program have not increased in five years, although the proportion over which USOE has exercised control has fluctuated. In view of this funding history, and the program administrator's (or anyone else's) inability to project the mind and will of Congress, the writer simply extended to FY '74 the same $28,262,000 the program has received in the past, and assigned 10 percent of that amount to the support of RDDE positions, as explained in the original study.

7. Small projects--the FY '74 figure is the projection of the administrator of this program.

8. Regular projects--funds are combined in this category from the handicapped children and youth program and the National Center for Educational Research and Development, USOE. The handicapped children and youth program portion of the total is based on a firm estimate of FY '74 funding by the program administrator. The NCERD portion of the FY '74 total is based on hard and detailed information from the program administrator through FY '72, and an extension of this information into FY '74 by the present writer using the guidelines stated in the first category above.

9. Title III centers--the funding history of this program has been as follows:

FY '68 - $209,000,000
FY '69 - 164,876,000
FY '70 - 116,693,000
FY '71 - 143,243,000
FY '72 - 146,248,000 (est.)

As was the case with the administrator of the state department program (category No. 6 above), this administrator was simply unable to project the mind and will of Congress. The funding history offered no consistent pattern, so the writer did not attempt to tread where the program administrator feared to step. The FY '74 projection for this program represents six percent (as in the original study) of a flat continuation of the program administrator's estimate of FY '72 funding.

10. NSF course content improvement program--the funding history of this program has been as follows:

FY '68	-	$ 13,500,000
FY '69	-	7,975,000
FY '70	-	6,200,000
FY '71	-	5,800,000
FY '72	-	5,800,000 (est.)

The administrator of this program thought the funding curve would "bottom out" in FY '71 and '72, and start a gradual climb thereafter. Based on his generalized projections, the writer arbitrarily assigned the value of $6,500,000 in FY '74 for this program.

Final projection. The baseline projection fails to account for populations of RDDE positions which are not supported by the selected USOE or NSF programs included in the study. The populations, identified in the original study as the components of the 1964 community, are examined in the paragraphs which follow.

1. School and college of education populations. The original study added to the basline projections the 160 persons employed in research bureaus in 1964; the 44 education personnel who were employed by state departments to staff RCU's; the 40 research stimulator-

coordinators who were employed by doctoral-granting institutions; and 2,261 individuals (in the Least Optimistic projection) who would be engaging in project activity.

In the absence of any substantial expansion of the funds available through the major USOE and NSF support programs included in the study, there is no basis for any projection beyond the number of persons who were already employed by other sources. There may actually be an increased number of individuals working on educational RDDE projects, but there is nothing in the data developed for this study which would indicate that is the case. Consequently, the writers did not project beyond the 1964 data. Thus, only the 1,000 individual project personnel identified in 1964 were included. The present study retained from the above populations only those positions which were supported by other sources in 1964, to wit:

160	personnel in research bureaus
44	personnel employed to staff RCU's
40	stimulator-coordinators
1,000	individual project personnel
1,244	total in schools and colleges of education

2. The positions identified in academic settings other than schools and colleges of education in 1964 so closely resembled each other that they can be presented in tabular form. All of these positions were added to the baseline projection, for the same reasons as were given in the discussion of school and college of education positions.

Setting	Bureau Personnel	Individual Project Personnel
Schools/departments of psychology	70	430
Other behavioral/social science depts.	64	463
Other discipline/academic depts.	20	471
College/university administration units	150	55
TOTAL	304	1,419

It should be pointed out that in categories 3-9, the numbers given are those for the number of RDDE personnel employed in the particular agency and not the total number of personnel employed in an RDDE agency.

3. U. S. Office of Education. There continue to be no better data available than the 1966 data cited in the original study. These indicated there were approximately 136 program directors and professional staff personnel in RDDE units within USOE and about 20 stimulators-coordinators of RDDE. All of these persons are engaged in facilitation or management of RDDE. All 156 positions were added to the baseline projection.

4. State departments of education. The states were supporting about 240 study, planning, evaluation, and research positions in 1964. They also supported 92 RCU positions not previously accounted for. There were 115 individual project people and 10 stimulators and coordinators. All were added to the baseline projection.

5. Schools and school systems. Research bureaus of school systems employed about 265 persons in 1964. Another five stimulators and coordinators were identified. All 270 were added to the baseline projection.

6. Private research institutes and agencies. No change was made in the 300 positions being supported in this setting in 1964; all were added to the baseline projection.

7. Professional associations. The 90 program personnel reported in this setting in 1964 were added to the baseline projection.

8. Inter-agency organizations. There were 50 persons employed in 1964 by such consortia as the Association of Great Lakes Colleges and the Compact of the States. This number has undoubtedly grown, but in the absence of any basis for estimating the extent of that growth, just 50 positions were added to the baseline projection.

9. Business and industrial organizations. This setting was not adequately represented in either the 1964 description or the baseline projections of the original study. One hundred fifty positions were identified. It is true that the "education industry" has not grown to nearly the extent projected, but that it has expanded is obvious from the number of new corporations which have been formed since 1964. Rather than limit the positions in this setting to the number inadequately identified in 1964, the writer has arbitrarily doubled it, asserting that there will be (if there are not already) at least 300 educational RDDE positions in business and industrial organizations throughout the country in 1974. In this setting, it is recognized, the writer is making a prediction rather than a projection.

To summarize, the following populations of educational RDDE personnel were identified as having been in existence for a period of time and likely to continue in existence without reference to the vagaries of federal funding:

Setting	Population
Schools and colleges of education	1,244
Schools and departments of psychology	500
Other behavioral and social science depts.	527
Other discipline and academic depts.	491
College and university administrative units	205

Setting	Population
U. S. Office of Education	156
State departments of education	457
Schools and school systems	270
Private research institutes and agencies	300
Professional associations	90
Inter-agency organizations	50
Business and industrial organizations	300
TOTAL	4,590

When the baseline projection of positions to be supported by selected USOE and NSF programs is added, we have the following final projection.

Baseline projection	4,079
Positions supported from other sources	4,590
Final projection of positions[9]	8,669

For comparative purposes, the reader will find it of interest that the original Clark and Hopkins study identified 4,125 persons in the 1964 educational RDDE community. Most of the growth which is indicated by the distance between the 1964 and 1974 totals undoubtedly took place during the short span in 1965 and 1966 when the new ESEA agencies and centers were staffing up. Although we do not have data to indicate the number of persons actually employed in RDDE positions at the present time, it seems reasonable to assume that most of the 8,669 projected to be needed by 1974 are already employed. The reasons for this assumption

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[9] [Editor's note] As mentioned in footnote 4, if one can accept the projected proportions of RDD made in the original study as valid, then the 8,669 positions shown above would be divided in this manner:

research:	2,861
development:	4,334
diffusion:	1,474

are that the economic indicators, at least, suggest that since 1966 there has been little expansion in the number of educational RDDE positions available--nor are funding program administrators projecting that there will be any extension in the capacity to support such positions in the near future.

Follow-up Study of Persons Employed

Questionnaires were sent to 46 project investigators in an attempt to learn whether the positions listed in the budgets of proposals approved by USOE were actually filled--as assumed by Clark and Hopkins. The questionnaires were distributed to a random sample of project directors in each of the USOE departments and divisions in the original study which supported project activity (as opposed to laboratories, centers, etc.). The number of questionnaires sent and usable returns received, by USOE program, were:

USOE Program	Sent	Received
Higher Education Research	15	11
Adult and Vocational Research	10	10
ERIC	5	4
Elementary/Secondary Research	6	4
Elementary/Secondary Curriculum	5	4
Handicapped Children/Youth	5	4
TOTAL	46	37 (80%)

Five of the questionnaires were returned with notes indicating they had been sent to the wrong person or could not be delivered. Four were simply not returned.

Of the 37 usable returns received, 23 (62 percent) reported no difference of any kind between the positions listed in the budgets submitted for approval and the personnel actually employed during the duration of the project.

A difference between the proposed project staff and the staff actually employed was reported by 14 investigators. The changes reported are listed below, grouped by the writer into two categories: (1) eight cases which could possibly affect the Clark and Hopkins manpower projection significantly, and (2) six cases which appeared unlikely to affect the manpower projection in any significant way.

Possibly significant changes in staffing

1. Used two fewer programmers than anticipated; also replaced two graduate assistants in education with a graduate student who had training in mathematical logic--which was needed in the study.
2. Added one programmer.
3. Added two writers and one visual artist.
4. Employed two research associates instead of a programmer.
5. Personnel desired were not available for employment.
6. A co-investigator was added; also a one-third time consultant.
7. One fewer research associate was employed; two additional graduate assistants were hired instead.
8. Did not employ one special coordinator, two research design specialists, one publications director, or six graduate student interns because they were not needed (these would have been short-term, part-time employees if they had been called upon).

Probably insignificant changes in staffing

9. Used 10 field workers for a brief period instead of two field workers for a longer period, because of shortened deadlines.

10. Three interviewers added (paid for each interview completed).

11. Employed four research assistants instead of four graduate assistants.

12. Two co-investigators worked one-half time on the project, rather than full-time as scheduled.

13. Added one half-time observer and two test scorers.

14. Employed 14 graduate students at an hourly rate.

The latter reports are termed "probably insignificant" because they appear to involve (1) para-professionals who would not have been included in the original study anyway, (2) persons who were probably employed less than the equivalent of 20 percent time for a year--which was the cut-off point used in the original study, and (3) differences in time or title rather than persons employed.

It is difficult to say what significance the first eight cases have for the manpower projection base. The additions and subtractions seem to fall into a rough balance, but it is recognized this could be said to be adding apples and oranges. There is nothing reported there (or anywhere in this section) which appears to the author to raise serious doubts about the validity of the assumption by Clark and Hopkins that the positions listed in budgets approved by the USOE did represent positions which would be filled by the employment of educational RDDE persons. In fact, the returns appear to substantiate the assumption.

Conclusions

1. The projections of the original Clark and Hopkins study indicated the 1964 population of 4,125 RDDE personnel would by 1974 increase at least three-fold, possibly seven-fold, but most likely five-fold. All three projections now appear to be overly optimistic. According to the data compiled for the present study, there will more likely be a doubling of the 1964 population by 1974, to approximately 8,669 persons, assuming all positions are filled.

2. The projection in this paper may be too pessimistic. It is likely there has been some expansion since 1964 among university personnel, state department RDDE personnel, private research institute personnel, and personnel in other settings, even with the slowdown in government support. And, in spite of the fiscal history for educational RDDE since FY '68, flat funding of federal programs is decidedly unusual, hence it seems unlikely that there will not be some expansion in federal support of educational RDDE between the present and FY '74. To repeat, however, the projection in this study does not take into account either of these factors, because there are no data available to support any such extension.

3. According to the information on economic indicators obtained from interviews with program administrators, there will be no upturn in the demand for educational RDDE personnel before FY '74.

4. It was valid to assume that the positions listed in the budgets of projects approved for federal funding in FY '66 accurately reflected jobs which would be opened up to educational RDDE personnel. Both the original and the present projections rest on this assumption.

Recommendations

1. If the third conclusion above is valid, then training program directors should counsel their students that there is no indication there will be any sizeable number of unoccupied positions in educational RDDE between now and 1974.

2. Administrators of training support programs or possibly AERA should take note of the group of approximately 4,000 persons who moved into the educational RDDE field in 1966-68, and, on the assumption these persons are not adequately or at least broadly trained, make provision for them to receive some advanced training while on the job.

3. During this hiatus in demand for newly-trained persons, administrators of training support programs, AERA, and others interested in training should take advantage of the opportunity to (a) engage in research on training, (b) re-examine the assumptions about training which have grown out of custom and habit, (c) explore possibilities for creating more of a demand for educational RDDE in settings where the demand has been weak, and (d) develop models, rationalized systems, and alternative techniques for providing more efficient and effective training to a broader variety of individuals.

4. The Office of Education, AERA, or both should begin now to develop a mechanism for regularly assessing manpower supply and demand in RDDE, and then use that mechanism to conduct a major census of RDDE manpower in the near future. Such a mechanism might borrow techniques from several studies, such as:

a. Buswell's study of education doctorates in 1954 and 1964.

b. Sieber's study of research units in 1964.

c. The National Register survey in 1964.

d. The Clark and Hopkins description of the 1964 community and their projections to 1974.

In addition, the possibility exists of collecting baseline or threshold data on the age of the National Institute for Education, as the above studies did for the age of ESEA-1965.

A new data-based effort is required, in any case, for sensible planning because all of the above studies and surveys have now aged to the point where it is difficult to relate them to present circumstances. If planning were begun now on a major census or survey, perhaps a set of arrangements could be worked out by 1974 or 1975 which would permit the results to be used as the base of a regularized annual or biennial survey of educational RDDE manpower. Until there is a nationwide census of people, training, and jobs, estimates of the congruence between future supply and future demand will remain more an art than a science.

Observations

1. It seems reasonable to begin training people in advance of a major new thrust, as the new National Institute for Education certainly will be. That has not been the practice in the past, however, and the projection in this chapter provides no basis for an operating level administrator to win support at this time to begin training to meet a future need. Experience has shown, however, that there must be training in advance of future needs; the large numbers of inadequately trained

persons who were forced into RDDE positions which arose after passage of ESEA is testimony to that belief. Therefore, it appears the impetus for training personnel to meet future needs will have to come from the very highest levels of decision-making in the Office of Education and/or HEW. Apparently it is only at that level that there is any firm view of what the future holds for educational RDDE.

2. The funding reverses of the past several years have caused more harmful effects than diminished job opportunities or cutbacks in programs and projects. Program administrators appear to be so uncertain (and frustrated) that long-term planning is being neglected. Bold innovation has been replaced with maintenance activity. Enthusiasm and drive have been replaced by timidity. One must wonder what other costs there have been and will be as a result of this induced set of behaviors.

A REVIEW AND SYNTHESIS OF STUDIES ON MANPOWER SUPPLY AND DEMAND IN EDUCATIONAL RESEARCH, DEVELOPMENT, DIFFUSION, AND EVALUATION

Manpower studies involving projections of future demand for research, development, diffusion and evaluation (RDDE) personnel are very difficult to conduct. Projecting a demand for trained personnel is complicated even during financially stable periods. When Federal funding practices take on many Monte Carlo characteristics, such projections become even more tenuous. Even if funding problems are not in existence (i.e., if projections for future demand are made regardless of the financial resources available), manpower studies are difficult to conduct because the projections are usually based (necessarily) on many assumptions. Hence, the projections are only as valid as the assumptions underlying them.

Nevertheless, in the past few years, the need for information to guide program planners has led several members of the educational research community to attempt to determine the number of trained persons presently in RDDE positions, the number of persons currently being prepared to fill existing and emerging RDDE positions, and the number of persons who might be needed by the research community at some specified future date. It is the purpose of this chapter to describe and synthesize those studies relating to manpower supply and demand. Specifically, the chapter contains information relating to the attainment of objective 5.2 of the current Task Force project, which was originally stated as: "To synthesize existing manpower studies based on nonfinancial projections." In addition to nonfinancial projections, the financially based projections prepared by Clark and Hopkins (1969) are also included in the synthesis.

Before the studies can be described, it is necessary to explain the process by which the studies were identified and chosen for inclusion in this report. The identification of studies relating to manpower supply and demand was accomplished as part of the work leading to the attainment of Task Force Objective 6. That objective was to identify and synthesize "extant studies of educational RDDE personnel or studies of variables directly related to such persons." The reader is referred to Technical Paper No. 27 in the Task Force series for a detailed description of the procedures used in the search, description and judgment phases of the work.[1] A brief overview of those procedures will be given here.

Standard library search methods (e.g., Psychological Abstracts, Education Index, Research Studies in Education, ERIC) were used to identify all works which might be relevant to the topic of research training. Services of the Smithsonian Institution's Science Information Exchange were also used to identify any current research underway in the area. Approximately 275 titles were thus identified. Of these 275, 150 articles, books and manuscripts were discarded because they were not reports of data based studies or because, after inspection, it was determined that their content was unrelated to RDDE training. The remaining 125 studies were deemed relevant to Objective 6. Of these 125, eight studies related in some way to the focus of this paper.

Those studies which could be obtained from authors, libraries or University Microfilms were read and, if they met the inclusion criteria described in Technical Paper No. 27, they were described in some detail and subjected to tests of methodological adequacy by members of the AERA Task Force staff. The description outline consisted of the problem statement, the statement of objectives, and the hypotheses or questions posed in the study. Data generation was described according to the population studied, the sample, the variables studied, and the instruments or techniques used to collect data. Data analysis was described in terms of the type of data generated for each variable (nominal, ordinal, interval or ratio), the statistical technique employed for each variable, and any errors discovered in either data reduction or analysis. Findings (narrative statements of numeric outcomes) and conclusions (interpretations or explanations of the findings) were listed.

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[1] Those procedures are also described fully in the first section of Chapter VIII of this report.

Each study was subjected to tests of methodological adequacy because of the necessity to have assurance of the credibility of the findings of each study included in the synthesis. It was reasoned that if there were methodological flaws in the study, the findings and conclusions of the study might not be valid and therefore should not be added to the growing knowledge base concerning the training of RDDE personnel. The adequacy of studies was judged by outside experts in relation to each of the following eight aspects of a study:

1. population (clearly defined? appropriate to the problem being investigated?)
2. sample (clearly defined? adequate size and representativeness?)
3. variables (clearly delineated? operationally defined? appropriate to the problem being investigated?)
4. instrument or technique used for data collection (objective? reliable? valid?)

5. response rate in survey studies (sufficient for adequate analysis? checks for nonrespondent bias?)
6. data analysis (appropriate statistical techniques employed? errors which significantly alter findings?)
7. findings (accurate translation from numeric to narrative outcomes? unequivocal?)
8. conclusions (warranted on the basis of the data presented?)

Finally, judges made general comments about each study and a recommendation as to whether it should be included in the synthesis of studies judged to be methodologically sound. (That synthesis is contained in Technical Paper No. 28 and in Chapter VIII of this report.)

Each study was judged by at least two persons. The first person to judge the study was the Task Force staff member who had written the description of the study. The second judge was an outside consultant (i.e., someone not connected directly with the Task Force) knowledgeable in research design, statistics, measurement, etc. Where there were differences of opinion between the first and second judges, a third judge was called upon to resolve the disagreement. Finally, a member of the AERA Task Force served as a consultant to synthesize the judgments made, summarize the comments made on the studies by the judges, and aid in the decision of whether the findings and/or conclusions of each study should be included in the synthesis of results.

There were no manpower studies identified which failed to meet the test of methodological adequacy. However, there were several studies which were excluded from the review process which led to the synthesis because the studies failed to meet the criteria of producing generalizable results and/or having enough relevant data based results to warrant the time required to describe and critique the total study. These studies included the twelve training consortia design studies submitted to the U. S. Office of Education in December 1970. Each of these studies contained plans for establishing and implementing programs to train development and evaluation personnel. Three of the reports pertain directly to the purpose of this chapter and include results of surveys on the perceived need for RDDE personnel in selected institutions, agencies, or regions. Therefore, those data are reported here. It should be noted that only a modified version of the description and judgment phases has been performed on these studies.[2]

One other study (the Gideonse report) described in this chapter was included in Technical Paper No. 27 even though on the surface it did not meet the criteria for inclusion in that paper. It was included because it was felt that it provided the most comprehensive overview available of

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[2] The procedure for describing and judging the training program reports included the following steps. A member of the Task Force staff read all 12 of the reports and selected those three which contained information relevant to the topic of this chapter. The relevant sections of the reports were described in terms of both the methods of data collection and the results of the data collection procedure. Then another member of the Task Force staff read those descriptions so that a consensual judgment of the validity of the findings might be made. The external validity of the findings was deemed questionable, but for the purpose of this chapter, that was not judged to be a sufficient reason to eliminate the findings. In terms of internal validity, it was more difficult to judge the adequacy of the findings. By their very nature, the three reports were unlike the final reports of most rigorous investigations. They were primarily conceptual design activities and the collection of manpower data was an ancillary activity aimed at identifying training needs. The results of these manpower needs surveys, reported in proposals submitted for further funding, were evidently intended to identify general parameters within which subsequent training would take place. Consequently, many of the details and the level of precision expected in most final research reports are lacking in the reporting of some of the results in the three design study reports included here. There are, therefore, several unanswered questions which limit the confidence one can place in the findings of these studies. However, it was felt that some of the data presented in the three reports were worthy of inclusion in the synthesis of results section of this chapter if the reader also keeps in mind the limitations in these reports discussed above. Specific limitations and unanswered questions are pointed out as they arise in the discussion of findings which follows.

American educational research, development and related activities. Because one section of the report was concerned with manpower supply and demand, the Gideonse paper is also included in this chapter.

In total, then, 12 studies dealing with manpower were reviewed and are synthesized herein.[3] They include the following:

Bargar, R., and Hagan, D. A survey of Ohio public school administrators for the purpose of evaluating the undergraduate research and development training program. 1970.

Clark, D. L., and Hopkins, J. E. A report on educational research, development, and diffusion manpower, 1964-1974. 1969.

Evans, G. The need for research, development, dissemination, and evaluation personnel in education. (Upper Midwest Regional Educational Laboratory) 1970.

Fleury, B. A study of factors relevant to the development of applied educational research training programs. 1968.

Gideonse, H. D. Educational research and development in the United States. 1969.

Goodwin, W. L., and Worthen, B. R. An interpretation of data from the AERA employment service, 1968-1970, and the 1969-70 telephone interviews: Implications for supply and demand and emphases in research and research-related roles. 1970.

Hood, P., *et al*. Design of a functional competence training program for development, dissemination and evaluation personnel at professional and paraprofessional levels in education. (Far West Laboratory for Educational Research and Development) 1970.

Oldefendt, S. J., and Worthen, B. R. An analysis of 1969 AERA employment service data: Areas of specialization reported by applicants and areas of specialization required for positions listed. 1970.

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[3] Five more studies are referenced in this chapter. They are *Technical Papers 13, 16, 24*, and *25*, and the Roaden Appendix in Clark and Hopkins (1969). They are not described in this chapter as the above 12 reports are because only one finding of relevance to the current objective was found. It was felt that adding the description of these studies would lengthen this chapter unnecessarily; all of the other reports included in the description section of this report include many more than one finding of relevance. A complete description of the four technical papers is presented in *Technical Paper No. 27*.

Rogers, W. T., Worthen, B. R., and Sanders, J. R. An analysis of 1970 AERA employment service data: Competencies reported by applicants and competencies required for positions listed. 1970.

Stufflebeam, D. L. Proposal to design new patterns for training research, development, demonstration/dissemination, and evaluation personnel in education. (The Ohio State University) 1970.

Worthen, B. R. A re-analysis of normative data from the National register of educational researchers: Career patterns of researchers in education with implications for recruitment. 1969.

Worthen, B. R., and Sanders, J. R. An analysis of 1968 AERA employment service data: Competencies reported by applicants and competencies required for positions listed. 1970.

The format for the remainder of this chapter is as follows. For each study included in the synthesis, a very brief description of the problem being studied and the way in which it was studied (i.e., data generation and analysis) will be given. Findings and conclusions relevant to the topic of this chapter will be incorporated in the synthesis of studies, which follows the description.

No report of the judgments of methodological adequacy made about the findings and conclusions of each of the studies will be given here. The reader is referred to Technical Paper No. 27 for a complete listing of those judgments for all of the studies included herein. An exception is the three training program reports which, as previously reported, were judged by two Task Force staff members to have presented findings which, with qualifications, were worthy of inclusion in this chapter. It should also be pointed out that only those findings and conclusions which relate to the topic of manpower supply and demand in educational RDDE are included in this synthesis. The reader is again referred to Technical Paper No. 27 for a complete listing of findings and conclusions, and to Chapter VIII for a synthesis of findings and conclusions *not* related to manpower supply and demand.

Description of Studies

1. Bargar, R., and Hagan, D. A survey of Ohio public school administrators for the purpose of evaluating the undergraduate research and development training program. In Investigations of factors influencing the training of educational researchers. Final report of project no. 3191, U. S. Office of Education, contract no. OE-6-10-146, 1970.

The investigators wished to determine the value of an undergraduate training program in educational research and development at the Ohio State University, particularly with respect to the use of graduates in the public school systems of Ohio. The survey was designed to obtain three types of information: (1) type of research and development positions presently existing in Ohio public schools; (2) an assessment of the number of positions which might be open to graduates of the training program; and (3) suggestions and reactions from administrators and research directors concerning the purpose and content of the training program.

The population was all public school systems in Ohio. A questionnaire was sent to a sample of this population; the sample included all of the larger districts in the state plus representative medium and small districts (N = 100). Sixty-seven percent of the districts in the sample returned completed questionnaires. Responses were analyzed in the form of frequencies and percentages.

2. Clark, D. L., and Hopkins, J. E. A report on educational research, development and diffusion manpower, 1964-1974. Bloomington: Indiana University Research Foundation, 1969.

With the advent of the Elementary and Secondary Education Act of 1965, a charge was made to create a community of researchers, developers, and disseminators who were capable of bringing research directly to bear on public schools. Existing models of research training programs, however, were limited in number and scope. The heart of the problem appeared to be the lack of information available to national and local decision makers who would be called upon to make vital decisions in regard to the nature of training programs to be supported and operated under Title IV of ESEA. The general objective of this study was to develop and supply data useful to policy makers and planners of training programs for research, development, and diffusion personnel in education. To accomplish this objective, achievement of the following sub-goals was necessary: (1) project the demand for existing and emerging research, development, and diffusion roles in education; (2) project the magnitude of the demand for particular types of research, development, and diffusion personnel in education; and (3) project the implications of these data for the recruitment, selection, and training of research, development, and diffusion personnel in education.

To accomplish sub-goals (1) and (2) above, the following procedures were employed. Data (money expended, personnel supported) were collected for programs and projects in progress in FY 1966 in the USOE support programs created and fostered by the ESEA of 1965. The same data were also collected for NSF's Course Content Improvement Program. The instruments used to collect much of these data were the proposals for programs and projects which had been approved for funding in fiscal year 1966. These proposals were sampled on the basis of this objective: "(1) to identify all of the diverse populations and (2) discover all of the various types of projects which existed within the programs selected . . ." (p. 131). Other data were obtained from interviews with administrators of the several programs.

Data reduction and analysis procedures are too complicated to be treated in anything but a cursory manner here. The reader is referred to Technical Paper No. 27 or to the original document itself for a more detailed description of the data analysis. In essence, what Clark and Hopkins did was to make three estimates of demand for trained manpower in educational RDD in 1974: a "least optimistic" projection, a "most optimistic" projection, and a "most likely" projection.

The subjects of interest in the attainment of sub-goal (3) were all the training projects funded under Title IV of ESEA, 298 selected projects (of 1,145 total projects) funded under Title III of ESEA, and all of the directors of Title IV research training programs plus 340 (unspecified) professors associated with research training programs.

The proposals from all of the Title IV programs were reviewed to determine funding for the programs, number of trainees in the programs, and characteristics of the training programs. A questionnaire was sent to the Title III project directors; in it were questions regarding characteristics of Title III staff members and directors (e.g., age, educational and employment history). Usable responses were received from 137 Title III centers involving 579 professional staff members. A letter was sent to the training program directors and faculty in which information was requested concerning a general program description. Information adequate for analysis was received from 47 institutions (there is no information as to how many institutions received the letter). Nonrespondent bias checks were not discussed. Data were described using frequencies and means.

Although the findings and conclusions of this study will be described in another section of this chapter, there is one more detail of the Clark-Hopkins study which should be mentioned now. That detail is the one general assumption underlying all of the projections made in the study: ". . . the educational R, D, and D community will not experience events which will alter its situation to any greater extent than did the ESEA of 1965. In other words, the general assumption is made that major political, social, and economic trends of the recent past will, with one caveat, continue. The caveat is that the limitations imposed upon program growth and expansion during fiscal years FY '67-'69 are viewed as unusually stringent and will not be continued during the period FY '71-'74" (pp. 120-121). Recent history has shown that this assumption has not held. The financial limitations imposed on program growth beginning in FY 1967 have remained to the present, and in some cases have become even more stringent. An updated version of the Clark-Hopkins projections, based on recent funding histories, is presented in Chapter VI of this report. The reader is referred to that chapter for a revised estimate of the number of educational RDDE personnel who might be supported in 1974.

3. Fleury, B. A study of factors relevant to the development of applied educational research training programs. (Doctoral dissertation, University of Massachusetts), 1968.

This study was composed of three parts. Part I was an examination of the Applied Educational Research Training Program at the University of Massachusetts. Part II was a study of the research training programs funded under ESEA Title IV. Part III was an investigation of potential employers of applied educational researchers. Because Part I is an evaluation of one specific program, it is excluded from further discussion.

The population for Part II of the study was the 85 ESEA Title IV research training programs.[4] Data were collected from grant request proposals, program brochures, and college and university catalogs of the sponsoring institutions. Variables studied were the roles of educational research and/or the researcher, the academic levels of training for educational research, and specific information about the training programs (e.g., entrance requirements, course requirements, apprenticeship experiences). The variables studied were given the name "key aspects of educational research training."

The population for Part III was the 50 state departments of education, the superintendents of Massachusetts school districts, and 15 (unspecified) major independent research institutes. These groups were surveyed for the following information: their views on the appropriateness of various levels of academic training for educational researchers, their previous pattern of employing educational researchers, their views on training curricula and field experiences, and their expectations for the employment of educational researchers. Ninety-four percent of the state departments, 73 percent of the institutes, and 77 percent of the district superintendents responded to the questionnaire.

A weighting system was devised so that the information gathered could be translated into recommendations for the University of Massachusetts training program. If a "key aspect" received 13 points according to the weighting system, the practice was highly recommended for adoption by the training program; if it received 10-12 points, it was recommended for adoption; if it received 6-9 points, it was considered experimental and recommended for immediate investigation; if it received 0-5 points, it was recommended for investigation at some later point.

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[4] Fleury gives the number of Title IV Graduate Research Training Programs as 85; however, there are 89 such programs (see Hopkins, et al. 1970). It is unclear why Fleury uses data on only 85.

A practice ("key aspect") could amass points in the following manner: if the practice was favored (i.e., if it was the modal response to an item) by the three employer's groups, it received one point per employer group; three points were assigned to the practice if it was the modal response of the Title IV trainers; seven points were assigned if all the available research supported the practice.

One problem encountered in the author's treatment of the data concerns the variables for which no data were gathered from the employers. In this case, the author weighted the training program response double what it would normally be according to the weighting scheme. There seems to be no rationale for this practice. Another problem is that with variables on which the employers and trainers differ, the author appears to arrive at an arbitrary resolution of the difference. Because of these problems, no attempt will be made in the synthesis section of this chapter to present any of the point totals for any key aspect. Responses to each question by training program directors and employers will simply be reported.

4. Gideonse, H. D. Educational research and development in the United States. Washington, D. C.: U.S. Office of Education, 1969.

This report serves as a review of the development, current status, and possible future of educational research and development in the United States. The Gideonse study is organized around the following major areas of concern:

1. The definition of educational research and related functions, and possible models for the relationships among those functions.
2. The organization of educational research in the U.S., according to both its sponsors and its performers.
3. The management of educational research and development.
4. Financial and manpower resources.
5. The substance of educational R and D, analyzed along six dimensions (e.g., the type of research function supported, topical areas of study, special characteristics of target groups), and its impact on educational policy practice.
6. Educational policy implications from R and D outcomes.

The section of the Gideonse report which is concerned with manpower resources is the only section which is relevant to the topic of this chapter. Thus, the other sections are eliminated from the discussion here.

Gideonse used the Clark and Hopkins (1969) study to establish a beginning estimate of the manpower supply for educational research. In order to supplement the Clark-Hopkins estimates, Gideonse uses two additional sources for estimates of manpower in related areas. Those two other sources are the National Register of Scientific and Technical Personnel (1966) and USOE reports on earned degrees and degree candidates in disciplines related to educational RDD. Finally, Gideonse turns to specific educational research manpower development activities of USOE to gather figures on the number of persons being trained annually in educational research and research-related activities.

5. Worthen, B. R. A re-analysis of normative data from the National register of educational researchers: Career patterns of researchers in education with implications for recruitment. In D. L. Clark and J. E. Hopkins, A report on educational research, development, and diffusion manpower, 1964-1974. Bloomington: Indiana University Research Foundation, 1969.

There were two unrelated problems investigated in this study. The first problem concerned the career patterns of educational researchers: what positions had these people held before they entered the research community? The second problem investigated was a specific aspect of the research training program--the apprenticeship experience. The following questions were posed in the study:

1. Are there manpower pools susceptible to recruitment [to the field of educational research] which are not being tapped?

2. Why is there a ". . . wide discrepancy between the stated acceptance of apprenticeship as a crucial training component and the failure to provide training opportunities to a great many prospective researchers?"

3. "Are the relatively few research assistantships now available being utilized to provide the type of experience which is most valuable to prospective researchers?"

Because the second problem (and questions 2 and 3 above) is unrelated to the topic of manpower projections, it will be eliminated from further discussion here.

The population was composed of the 5,121 persons who identified themselves with the educational research community by returning written responses to a questionnaire submitted to them by Bargar, and who in so doing were included in the National Register of Educational Researchers. Worthen collected no new data of his own; the questionnaires collected by Bargar in his study (Bargar, Guba, and Okorodudu, 1965) provided the data for Worthen's study.

For the first objective (to identify manpower pools susceptible to recruitment efforts by looking at the career patterns of persons now in educational research), the investigator excluded from his sample all persons in the population who devoted less than 20 percent of their total professional time to research. Those questionnaires which remained were then sorted into 16 categories on the basis of the major position of the respondent. Any respondent who could not readily be assigned to one, and only one, category was excluded from the analysis. Data from 1,755 persons remained available for study.

The variables studied were census-type data (sex, present position, percentage of time spent in research activities, major area and date of highest degree) and a sequential listing of previous professional positions (including position title, name of institution, and inclusive dates of employment). Chi-square tests of significance were applied to the data. The professional position data were tabulated by categories.

6. Worthen, B. R., and Sanders, J. R. An analysis of 1968 AERA employment service data: Competencies reported by applicants and competencies required for positions listed. Technical Paper No. 6. Boulder, Colorado: AERA Task Force on Research Training, 1970.

Oldefendt, S. J., and Worthen, B. R. An analysis of 1969 AERA employment service data: Areas of specialization reported by applicants and areas of specialization required for positions listed. Technical Paper No. 7. Boulder, Colorado: AERA Task Force on Research Training, 1970.

Rogers, W. T., Worthen, B. R., and Sanders, J. R. An analysis of 1970 AERA employment service data: Competencies reported by applicants and competencies required for positions listed. Technical Paper No. 8. Boulder, Colorado: AERA Task Force on Research Training, 1970.

Goodwin, W. L., and Worthen, B. R. An interpretation of data from the AERA employment service, 1968-70, and the 1969-70 telephone interviews: Implications for supply and demand and emphases in research and research-related roles. Technical Paper No. 10. Boulder, Colorado: AERA Task Force on Research Training, 1970.

The purpose of the first three studies listed above was to provide needed information about the supply of and demand for trained personnel in educational RDDE. To accomplish this objective, analyses were made of existing data from the placement service of the 1968, 1969 and 1970 conventions of the American Educational Research Association. Technical Paper No. 10 was an attempt to integrate data from these three studies into a meaningful analysis of manpower trends. Because of the interrelatedness of these four papers, this abstract deals with them collectively.

Application forms (standard U. S. Department of Labor convention employment service forms) and employer vacancy forms from all prospective employees and employers registered with the placement service at the AERA annual meetings, and Task Force forms on which applicants and employers listed competencies possessed and needed were the sources of data for the studies. For the applicant, the variables studied were type of position sought, his area(s) of competence, and the type of organization in which he sought employment; for the employer, the variables were type of position available and competencies required by a person to fill that position. The operational definition of "type of position" was RDDE position, RDDE facilitative position, and non-RDDE position. Tabulation of vacancies and applicants by "competency" and "type" was presented, as well as category percentages.

7. Training Program Proposals.

The three proposals which contained data deemed relevant to this chapter were those submitted by The Ohio State University, the Far West Laboratory for Educational Research and Development, and the Upper Midwest Regional

Educational Laboratory. The parts of the proposals concerned with manpower supply and demand will be described separately below.

A. The Ohio State University. This consortium group conducted a context evaluation to determine the current state of educational RDDE activities and needs. Included in the context evaluation were two methods of data collection which provided information on the supply of and demand for trained personnel in educational RDDE. Those two methods were:

1) ". . . an interview guide structured to gain a wide range of knowledge relating to RDD and E activities now being conducted by various agencies and activities that they perceive their agencies engaged in for the future. All consortium members were interviewed and in addition various individuals who had expertise in the areas of research, development, diffusion, evaluation, environmental analysis, and management were contacted . . . The interview guide . . . provides input regarding needs for the training program, opportunities for training, and problems that might be encountered" (pp. 9-11, Vol. III).

2) "A survey of the fifteen regional educational laboratories was conducted in an effort to provide two types of data. Two survey instruments were developed: Professional Employee Profile and Director's Questionnaire. The Employee Profile sought data relating to their work activities and training. The Director's Questionnaire sought data relating to the activities, training areas, employment trends, and needs for educational specialists within the educational laboratory network" (p. 140, Vol. III). A total of 13 Director's Questionnaires and 280 Employee Profiles (representing 12 RELs) were returned.

B. Far West Laboratory. "In order to establish a more detailed estimate of regional demand and to identify prospective employers an extensive effort was undertaken to establish who were the employers of educational and training RDD and E personnel in northern California, and especially in the greater San Francisco Bay area. Names of prospective employers were compiled from personal knowledge of consortium members, from professional and organizational directors, from the Foundations Directory (1970), and from U.S.O.E. Current Projects Information (July, 1970).

"Through October 31 [1970], 115 organizations and firms were contacted, with 34 reporting that they employed personnel in educational or training R, D, D or E" (p. D9, Vol. 2).

C. Upper Midwest REL. "The data presented in this report does not represent a survey of what agency directors say they need, but judgments of informed experts about personnel likely to be needed in various activities for each category of agency. Care was taken to find individuals who were informed and in the mainstream of current agency activity. . . . The need study deals with four separate areas or groups of agencies where R, D, D, and E personnel are likely to be needed: (1) local, intermediate, and state education agencies, (2) Regional Laboratories and Research and Development Centers, (3) colleges and universities, and (4) educational or training divisions of industrial firms.

"The prime concern was to find data relating to needs in the five state area (Minnesota, Iowa, North Dakota, South Dakota, Wisconsin). However, where other data became readily available it was also included . . ." (pp. 1-2, Design Document I).

Manpower needs for (1) above were "compiled by the project staff with the aid of personnel from the Minnesota Department of Education. Several local school district officials also contributed opinions on the future needs of the schools. The staff and consultants first estimated the roles and skills which would be needed by local, intermediate district, and state department R, D, D, and E personnel. Then an estimate was made of the number of persons likely to be needed in each of these categories in various school district size categories" (p. 3, Design Document I).

Needs for (2) above were determined by sending a letter to 31 RELs and R and D Centers. In this letter, a request was made for a copy of the agency's organizational chart, job descriptions for positions shown on the chart, and a summary of present and projected research personnel needs of the agency. "Less than one-half of the agencies responded. Of those which did respond most sent an organizational chart but explained that no position descriptions were available. Only a few sent adequate information, giving position descriptions and detailed projections" (pp. 24-25, Design Document I). As a result of this scanty information, no projections were made for this category.

Needs for (3) above involved the following processes for collecting estimates of the numbers of research personnel likely to be needed in institutions of higher learning:

1) A list of all the colleges and universities in each of the five states in the region was compiled.
2) Project staff members surveyed "knowledgeable college administrative personnel" (including State Departments of Education personnel, members of the State College Boards and Junior College Boards, and various college and university research directors) regarding

a) number and type of employees doing institutional R, D, D, and E activities in colleges and universities,

b) number and type of personnel engaged in college or university R, D, D, and E activities, but employed at the state level (e.g., employees of State College Board),

c) projected levels of employment for such personnel by the 1972-73 school year.

Needs for (4) above produced no data pertinent to the topic under discussion here.

Synthesis of Findings

This section of the chapter includes four sub-sections: (1) findings relating to the number of trained persons presently in RDDE positions, (2) findings relating to potential manpower pools for RDDE training, (3) findings relating to the number of persons being prepared to fill existing and emerging RDDE positions, and (4) findings relating to the number of persons who might be needed by the RDDE community at some specified future date.

Personnel Presently in Educational RDDE.

The only estimate of the size of the nationwide community of RDDE personnel was made by Clark and Hopkins (1969). Based on data from Buswell (1966), Bargar, *et al*. (1965), Sieber (1966) and others, they estimated that there were 4,125 full-time equivalent persons engaged as professional staff members in research and research-related activities in 1964.[5] Further, they estimated that these 4,125 persons were divided among the three functions of research, development and diffusion as follows: research - 95.6%, development - 3.2%, and diffusion - 1.2%.

Clark and Hopkins presented three projections of the number of RDDE personnel likely to be required in 1974. The most optimistic projection was 27,015, the most likely projection was 19,436, and the most pessimistic projection was 12,827. In Chapter VI above, Hopkins revised those projections on the basis of severely reduced funding for educational RDDE and estimated that approximately 8,669 RDDE personnel will be needed in 1974. If one assumed linear growth from 1964 to 1974,[6] the most likely projection of RDDE personnel in 1971 based on the original Clark-Hopkins projections would be 14,843. A similar projection based on Hopkins'revised estimate would be about half that number--7,306 RDDE personnel in 1971.

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[5] The assumption is made by the authors that Clark and Hopkins used the term "professional staff member" to refer to a person at the doctoral or master's level. This assumption is based on the fact that the studies cited by Clark and Hopkins as the basis for their baseline projections deal, for the most part, with persons completing graduate study. Buswell (1966) conducted a survey of educationists who had received their doctorate in 1954. In the National Register of Educational Researchers, Bargar, et al. (1965) report that 82.3% of the persons listed hold the doctorate and 16 percent have a master's degree. The Sieber study (1966) is somewhat more equivocal in that it refers only to "professional personnel" of research bureaus and institutes. Sieber does say that "Most of the professional persons associated with research units are non-staff faculty members whose work is facilitated by the unit" (Sieber, 1966, p. 95). Based on the support given by the Buswell and Bargar studies, and to a lesser degree by the Sieber study, the assumption is reiterated that Clark and Hopkins use the term "professional staff member" to refer to persons at the doctoral or master's level. This assumption is important because many of the findings presented later in this chapter report the number of RDDE personnel at the different academic levels. If any comparisons are to be made between the Clark-Hopkins findings and other findings presented herein, then it is necessary that the above assumption be accepted.

Several smaller studies have been conducted more recently to determine the number of professionals and paraprofessionals in RDDE activities in specific agencies or geographical regions. It is reported in the Far West Laboratory's training program proposal (Hood, et al., 1970) that 985 professionals and paraprofessionals were employed in educational or training RDDE work in 34 organizations in the northern California area (especially in the greater San Francisco Bay area). Four hundred forty-six of these persons were at the doctoral or master's level (178 with a doctorate, 268 with a master's degree). On the surface, these estimates seem reasonably in line with the projections of Clark and Hopkins. Bargar, et al. (1965) reported that about 14 percent of his national sample of educational researchers resided in the Pacific states (California, Oregon, Washington, Hawaii, and Alaska). This provides a basis for comparison, resulting in an estimate of between 959 and 1864 RDDE personnel (at doctoral or master's levels) in these states in 1970.[7] In this context, 446 doctoral or master's RDDE personnel in Northern California seems somewhat high, but not seriously out of line since that region is one of the most populous in the Pacific states. Such a direct comparison of data may be unwarranted, however, since the Far West Laboratory data are hard to interpret for at least three reasons. First, it is unclear what precise kind of organization is included in the group of 34 which are reported as employing RDDE personnel. Also, the person within each organization who reported the number of RDDE personnel who were employed is not specified, making it difficult to assess the probable accuracy of the reports. Finally, no operational definition of "educational or training RDDE" is given. It is very likely that the term "educational or training RDDE," as used by the Far West Laboratory group, is much broader than (a) the term "educational RDDE" as used in this chapter and elsewhere in the work of the AERA Task Force, or (b) the term "educational RDD" as used by Clark and Hopkins. If this is true, many of the persons reported by the Far West Lab as RDDE personnel may not qualify according to Task Force definitions (see Technical Paper No. 1) or definitions of Clark and Hopkins as being a member of the educational RDDE community.

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[6] The imposition of a linear growth curve on these data may do an injustice to the rationale underlying either set of projections. However, without a sufficiently detailed description of how the projection curve might intercept intermediate years, no other way to estimate 1971 personnel numbers is readily apparent. If, however, growth was fastest in the years immediately following passage of the ESEA of 1965, as would logically be expected (and as implied by Hopkins in Chapter VI), then the 1971 projections listed above are likely to be underestimated to some unknown degree.

The Ohio State training program proposal (1970) gives two figures for the number of persons currently employed in RDDE activities. Based on interviews conducted with consortium members and others, it was reported that there were 390 RDDE personnel (133 with a doctorate, 16 with an MA) employed in the consortium member agencies (The Ohio State University Development Faculty; The Ohio State University Evaluation Center; The Center for Vocational and Technical Education, The Ohio State University; Cincinnati City School System; Saginaw, Mich. City School System; Illinois Institute of Technology Research Institute; Montana State Department of Education; Rhode Island State Department of Education; Dallas City Schools). From the survey of regional laboratories it was learned that there were 65 educational development specialists (16 with a PhD, 23 with an MA) employed in the labs. Here again it is necessary to point out some problems associated with these data. Although it was stated that interviews were conducted with representatives of all consortium member organizations and various other individuals who were knowledgeable in the field of educational RDDE, the list of interviewees provided in the proposal does not appear to include a person from each consortium agency. Yet when the figures given above are presented, a footnote explains that the numbers reflect a compilation of all agencies in the consortium. It is unknown how information was obtained for the agencies not represented by an interviewee. Before one can properly interpret the regional lab data, it is necessary to know what is meant by an educational development specialist. According to the questionnaire sent to the directors of the RELs, an educational development specialist is a person who possesses a constellation of skills and training such as the following:

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[7] These figures are computed by the following methods: (a) apply the linear growth curve to both earlier sets of projections to arrive at estimates in 1970 of 13,312 from the original Clark-Hopkins projections and 6,851 from Hopkins' revised projection; (b) assume RDDE personnel in 1970 would be distributed regionally about the same as were Bargar's group of educational researchers in 1964; and (c) take 14 percent of each of the estimates in (a) above to result in estimates of 1864 from the Clark-Hopkins projections and 959 from the Hopkins revised projection.

Skills

1. Provide information for program planning and design
2. Engineer prototypic packages (innovative solutions and programs) for educational problems
3. Create widespread awareness of the tested solutions and programs
4. Monitor and adjust the solutions and programs after widespread installation
5. Conduct basic scientific inquiry
6. Test and evaluate innovative solutions and programs
7. Train target audiences in the use of solutions and programs
8. Assess educationally related needs and problems
9. Invent solutions to operating problems
10. Demonstrate the effectiveness of solutions and programs

Training

1. Statistics
2. Learning theory
3. Social psychology
4. Audio-visual
5. Marketing
6. Sociology
7. Research design
8. Testing and measurement
9. Systems theory
10. Educational administration
11. Advertising
12. Political science
13. Philosophy of science
14. Data processing
15. Theories of teaching
16. Curriculum development
17. Communication theory
18. Decision theory
19. Information theory
20. Journalism

Operationally, this seems to be an extremely broad definition of a specialist in educational development. At least it is at variance with most current definitions of development proposed either by theoreticians (e.g., see Technical Papers No. 1 and 4 and Clark and Hopkins, 1969) or practitioners in curriculum development projects. Many of the skills listed above would more likely be possessed by the researcher (e.g., #5), the diffuser (e.g., #3, #7), or the evaluator (e.g., #1) than by the developer. Therefore, it is necessary for the reader to avoid the mistake of using the terms "developer" and "educational development specialist" interchangeably. The latter term is a broader one and may perhaps better be used as a synonym for the total range of RDDE, as used in this report.

Both the Ohio State and Far West Laboratory surveys indicate that there are a substantial number of sub-doctoral personnel employed in RDDE activities. It is unclear, however, whether these sub-doctoral personnel (a) have actually had any training in educational RDDE, (b) are employed primarily because not enough educational RDDE doctorates are available (although other data will be presented later which cast doubt on this possibility), or (c) even need specialized training to perform their duties. If the sub-doctoral personnel identified in these surveys do indeed need specialized training, one must wonder how they are obtaining that training. Roaden (1969) lists 47 universities and other institutions which offer a total of 54 research training programs. Only five of those 54 programs prepare personnel at the master's level and six at the undergraduate level. Worthen, et al. (in press) reported that of the 89 Title IV graduate research training programs in 1969, only nine prepared personnel at the master's level. If the above hypothesis is correct--

that sub-doctoral personnel do need specialized training in RDDE--then it is clear that more training programs designed to prepare RDDE personnel at the sub-doctoral level are needed. The three consortium training projects recently funded by USOE (Ohio State, Far West Lab, Learning R and D Center) should help to fill this need.

Manpower Pools Available for Recruitment into Educational RDDE

It has been argued that there already exist several manpower pools which might be tapped to meet the demand for educational RDDE personnel. Several studies have examined the size of those manpower pools and the degree to which certain of them might be more susceptible to recruitment than others.

Gideonse (1969) reports the number of doctorates conferred in 1966-67 in the fields of psychology, anthropology, sociology, economics and linguistics, plus ten percent of the education doctorates,[8] as 2,663. The number of doctorates in the same categories expected in 1967-68 was 3,358. He also reports that there are 22,475 doctoral and 11,914 master's level persons in psychology, economics, sociology, anthropology and linguistics among the persons listed in the National Register of Scientific and Technical Personnel. Gideonse draws no conclusions regarding the potential contribution to educational RDDE of any of these persons, but the presentation of these figures does imply the existence of a fairly large manpower pool in disciplines related to education which might be available for research and research-related activities in education. Whether or not recruitment of such personnel into educational RDDE can be conducted effectively is still a moot point that will be resolved only by further research or actual attempts to make such recruitment work.

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[8] Ten percent of the total number of doctorates in education were chosen on the grounds that this is a fair approximation of "research" degrees in education.

Worthen (1969) looked at manpower pools already in the educational community to see which of these might be most susceptible to recruitment into educational RDDE. He reasoned that if educational researchers tend to have certain professional background experiences more often than others (i.e., if they were more often public school teachers than guidance counselors, for example, before they moved into research positions), then recruitment efforts should be specifically aimed at those occupational groups which most often appear in early stages of researchers' career backgrounds.[9]

Public school teachers appear to be the most promising group from which potential educational researchers might be recruited.[10] They appeared to be an immediate target group for recruitment into positions as research staff members in public schools; they appeared to be long-range target groups to fill the following positions:

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[9] It should be noted that sometimes a group was considered in this study as both an immediate and a long-term recruitment group for a certain position. This occurred when the data showed that personnel in a certain research position often moved from one job such as a public school teacher to another job as an academic instructor to another job as a research staff member, but might just as often have moved directly from the position of public school teacher to research staff member. In such a situation, public school teachers would be considered both an immediate and a long-term target group for the position of research staff member.

[10] It should be kept in mind that the focus here is on recruitment into RDDE training programs, not recruitment into RDDE itself. Whereas some of the persons in Gideonse's lists probably possess sufficient skills to move directly into RDDE work in education, this is unlikely to be true for many public school teachers or persons in several of the categories discussed below.

It should also be noted that, given the current oversupply of teachers in many areas, persons graduating with teaching certificates may be more susceptible than ever to recruitment into RDDE training programs.

a. research directors in
    1) public schools
    2) state education agencies
    3) professional associations
    4) private research agencies
    5) college and university institutional research units, research programs, and educational research bureaus
b. research staff members in public schools
c. stimulators and coordinators of RDDE activities
d. individual research personnel in schools of education.

Another promising, and perhaps more immediate, target group for recruitment comprises academic instructors. They may be considered an immediate target group for the following positions:

a. research directors in college and university institutional research units, research programs, and educational research bureaus
b. research staff members in
    1) private research agencies
    2) college and university research programs
c. stimulators and coordinators of RDDE activities
d. individual research personnel in
    1) schools of education
    2) other disciplines and academic departments.

Academic instructors also appear to be a long-range target recruitment group for the positions of:

a. research directors in college and university institutional research units and research programs

b. research staff members in

   1) private research agencies

   2) college and university research programs

c. individual research personnel in other disciplines and academic departments.

Public school administrators form an immediate target recruitment group for the position of research director in (1) public schools, (2) state education agencies, (3) professional associations, (4) private research agencies, and an intermediate target group for the same positions in college and university bureaus of educational research.

Research assistants serve as an intermediate target recruitment group for the position of research director in private research agencies. They may be considered both a prime immediate and long term recruitment group for the position of research staff member in (1) private research agencies and (2) college and university research programs.

As was previously noted, persons in all of these groups may only be considered potential recruits to the educational RDDE community. Without further research or actual attempts to recruit these personnel, no definitive statements may be made.

One might question the need to recruit persons to the field of educational research when apparently all present positions in educational RDDE can easily be filled from the present pool of RDDE trainees. Data reported in Technical Papers No. 6, 7, and 8 of the Task Force series (and discussed in a later section of this chapter) indicate this to be the case--there may indeed be an oversupply of trained RDDE personnel. If this is true, one may even argue it is unethical to recruit more persons into a field where there are not enough jobs to begin with. However, such an argument ignores two facts. First, the fact that there may be a current oversupply of RDDE trainees in education does not necessarily mean that there is an oversupply of talented RDDE trainees in education. It is probable that continued vigorous recruitment efforts aimed at attracting able young trainees into the field would have large dividends in the conduct of quality RDDE work. Second, the fact that there is a current oversupply of trainees should not create pessimism about the future of educational RDDE as a career possibility. The proposed National Institute for Education and other developing RDDE programs may well require additional RDDE personnel for the future. These trends are unclear, but it would seem unwise to assume the market for RDDE trainees would remain saturated for a prolonged period.

Present Trainees in Educational RDDE

Even though there appear to be extant manpower pools which might be susceptible to recruitment efforts by members of the educational RDDE community, the first source of manpower to fill existing and emerging RDDE positions is obviously the group of persons who are currently being trained in RDDE. Several studies have been conducted which present information on the number of trainees in current training programs.

Gideonse (1969) reported the number of persons involved in all of the Title IV training programs (undergraduate, graduate, postdoctoral, and institutes) in the years from 1966 to 1969. In 1966, 2,542 persons received some sort of training in educational RDDE through Title IV programs of all types; in 1967, the number was 1,934; in 1968, it was 2,291; and in 1969, it was 2,579. It should be noted that 1967 was the last year that the undergraduate research training program was in existence. The fact that the total number of persons receiving training remained relatively stable after that is accounted for by the increased number of participants in institutes. Numbers of persons in the graduate and postdoctoral training programs remained constant during 1968 and 1969.

In reviewing trainee numbers, it should be kept in mind that there is not a direct ratio between the numbers presented by Gideonse and the number of "new" members of the educational RDDE community. Participants in the postdoctoral and institute programs are likely to be mostly persons who are already practitioners in the field who return to gain more specialized knowledge. Only those trainees graduating from the Graduate Research Training Programs each year are new additions to the field. Gideonse lists the number of Title IV-supported trainees as 732 in 1966, 974 in 1967, 809 in 1968, and 809 in 1969. Hopkins, et al. (1970) listed 927 trainees in the Graduate Research Training Programs during the 1969-70 academic year.[11]

Since the doctoral program is typically a three year program, it seems reasonable to assume that about 300 persons graduate from the programs and enter the RDDE field each year. A check of the progress reports for 1969-70 (which contain lists of graduates during that year) shows this assumption to be correct at least for 1969-70.

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[11] Not all of the 927 persons listed as trainees are supported by Title IV funds. What Hopkins, et al. (1970) refer to as the "ripple effect" of Title IV training programs accounted for 118 nonstipend trainees being prepared during that year along with the 809 Title IV-supported trainees in the 89 research training programs. It is the opinion of Hopkins, et al. that "It is doubtful if a large proportion of the nonstipend group would be receiving systematic training in educational research in the absence of the Title IV training programs" (Hopkins, et al., 1970, p. 15). If this opinion is correct, then the phasing out of the Title IV Graduate Research Training Programs (which will be discussed later in this chapter) causes even more of a loss of potential RDDE personnel than would be thought by looking only at the number of Title IV-supported trainees.

There is corresponding information in the Clark and Hopkins (1969) report. They say that "The real quantitative effect [of the Title IV programs] rests in the (1) Graduate Research Training and (2) the Institute and Special Training Project areas" (p. 304). Their estimate of the number of RDDE personnel who will be graduated each year from the graduate training programs is between 300 and 400. Assuming continuance of the funding level of 1968, they projected the total number of newly trained personnel between 1966 and 1974 to be 2650. Of course, it is now apparent that the funding level of the Title IV training programs has not been continued at expected levels. Several Graduate Research Training Programs were eliminated in 1970 and all are being phased out at present. The total amount of money to be spent on training activities was cut in FY '71 from $6.25 million to $2 million, with the further proviso that the $2 million was to be spent on newly announced projects rather than on existing programs (Educational Researcher, September 1970, p. 10).

The three newly developed training consortia which have recently been funded by USOE will be training a total of approximately 225 persons at the graduate level (doctoral and master's) over the next three years.[12] These persons will be receiving training in evaluation (the thirty doctoral and ninety master's level students at Ohio State), development (the 36 students at the graduate level at LRDC), and diffusion (the fifty to eighty master's level students at the Far West Lab, who will also be receiving training in evaluation and development). The training consortia programs will also be providing training in development, diffusion, and evaluation to approximately 475 paraprofessionals. Together, then, the training consortia will be producing approximately 700 newly trained personnel over the next three or three and one half years. Remembering that the Graduate Research Training Programs have been producing about 300 newly trained personnel per year (for a total of about 900 over the next three years), it can be seen that the number of educational RDDE persons entering the field from Federally supported training programs will be reduced by about 200 overall over the next three years. However, if one excludes paraprofessionals, the reduction at the graduate level is more severe -- a reduction of 675 in all, or 225 per year. This means that the shift in support from the original Title IV programs to the training consortia will result in only 25 percent as many graduate trainees per year as has previously been the case. Although additional consortia may be funded, it appears at the moment that the emphasis is clearly moving away from graduate training in research to training paraprofessionals and some graduates in educational DD and E.

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[12] In the proposals submitted by The Ohio State University and the Far West Laboratory, projected numbers of trainees were given for the duration of the program (three years for the Far West Lab program, three and one half years for the Ohio State program). Learning Research and Development Center (LRDC), however, listed only the expected number of trainees for the first year of the program. In order to compare the training consortia programs with the Title IV Graduate Research Training Programs, it was necessary to simply triple the number of trainees attributed to the LRDC program. This may be an injustice to LRDC, for it may be their intention to expand their program and train more persons in the second and third years. However, in the absence of further information, it was impossible to make overall numerical projections without making this assumption.

Apparently the short term training programs supported under Title IV will be seriously reduced if not completely eliminated, resulting in a loss of retraining or short term training for approximately 1500 persons per year. The three training consortia will be providing short term training in D, D, and E to approximately 1100 persons over the next three or three and one-half years. This is far short of the approximately 4500 served by Title IV in-service programs during the same time period. Since the necessity of keeping up to date on current developments in the field is quite pronounced in educational RDDE, this could jeopardize the quality of work in these areas by providing insufficient retraining or short term training to upgrade skills and prevent obsolesence. Again, since Clark and Hopkins (1969, p. 329) report that short term training opportunities were primarily in research,[13] this represents a dramatic shift in training away from research and toward development, diffusion, and evaluation.

Task Force Technical Papers No. 6, 7, 8 and 10 provide some information on the number of persons looking for jobs in educational RDDE. At the 1968 annual meeting of the American Educational Research Association, there were 811 persons registered as applicants with the placement service; in 1969, the number of applicants dropped to 569;[14] in 1970, it rose again to 727. The applicants were differentiated on the basis of whether they were seeking a RDDE position, a RDDE-facilitative position, or a position not related to RDDE. This differentiation resulted in the finding that the number of persons seeking RDDE or RDDE-facilitative positions fell from 655 in 1968 to 516 in 1970, while the number seeking nonresearch positions rose markedly from 121 in 1968 to 210 in 1970. In 1968, there were 2.03 applicants for every RDDE or RDDE-facilitative position vacancy listed with the placement service; in 1970, the ratio had dropped to 1.79 applicants for every vacancy in those two categories. Given the recent scarcity of positions, this trend seems to run counter to the general increase in number of applicants per position opening. Of course, one cannot assume, given a tight job market, that all persons applying for RDDE or RDDE-facilitative positions are sufficiently trained for these positions (or have actually received RDDE training per se). However, since some 300 trainees graduated from the Title IV Graduate Research Training Programs alone each year during this period, it seems reasonable to assume that most of the applicants did graduate from programs which provided them with relevant RDDE training.

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[13] Of 35 institutes funded during fiscal year 1966, 25 provided training in research, 8 in development, and 2 in diffusion.

[14] It is not possible to be certain, but one factor which may have influenced this reduction was the site of the 1969 annual meeting. The convention was held in Los Angeles, whereas AERA draws larger proportions of its membership from the upper Midwest than from other sections of the country. The expense of traveling to the West Coast may have been a deciding factor -- especially for students -- in whether or not they attended the convention. It is reasonable to assume that the fewer students there are at the convention, the fewer persons there will be registered with the placement service.

Fleury's study (1968) provides some information on the type of training being provided to persons in the Graduate Research Training Programs. He found that 94.1% of the programs were training personnel for research positions, 23.0% were training personnel for development positions, and 5.8% were training personnel for diffusion positions. This would partially corroborate a conclusion reached by Clark and Hopkins (1969) that even though there appears to be extensive fluctuation in the nature of the demand for RDD personnel, ". . . the response of the field has been to replicate in its training programs the proportions of personnel found in the 1964 R, D, and D community" (p. 422). It will be remembered that those proportions were 95.6%, 3.2%, and 1.2% for research, development, and diffusion, respectively. The noticeable deviation from the estimates is in the area of development, where the emphasis on training is seven times that reported by Clark and Hopkins.

In summary, it appears that up to the present time there have been approximately 300 graduates from the Graduate Research Training Programs each year. The relative emphasis on training researchers, developers, and diffusers has been in the ratio of 16:4:1 (Fleury, 1968).[15] Since over 500 persons registered with the AERA placement service in 1970 and indicated that they were seeking RDDE or RDDE-facilitative positions, there apparently are over 200 persons who view themselves as trained in educational R, D, D, or E who have no connection with the Title IV Graduate Research Training Programs. Of course, some of those 200 are persons presently holding RDDE or RDDE-facilitative positions who are seeking advancement in the field. But there are likely to be others among those 200 who are entering the field of educational RDDE for the first time and who, presumably, have some degree of competence in R, D, D, or E. Some data on non-Title IV research training programs are presented in Chapter V of this report. Of 83 institutions which responded to a questionnaire and indicated that they had research training programs, 53 were not connected with the Title IV Graduate Research Training Program. The 53 non-Title IV programs are presently training 443 persons at the subdoctoral level (full and part time students) and 495 persons at the doctoral level (full and part time). Thus it would appear that the phasing out of the Title IV programs will not dry up the supply of newly trained RDDE personnel entering the field. If indeed there are a large number of persons being trained in non-Title IV programs and if the training consortia programs do produce the estimated 700 persons over the next three years as anticipated, it appears that the supply of trained RDDE personnel will still be at least adequate when compared to the number of positions presently available in the current depressed job market for educational RDDE. Of course, if the National Institute for Education comes into existence, the job market may "boom" again (as it did immediately after passage of the ESEA in 1965).

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[15] Unfortunately, evaluators were not differentiated by Fleury. Most probably they were grouped in either the research or development categories.

The foregoing discussion has been concerned simply with numbers of trainees. The data presented could be interpreted to argue that there are presently too many trained RDDE personnel for too few jobs. However, this completely ignores the question of quality of the trainees. As was argued in the preceding section on manpower pools available for recruitment, attempts must be continued to attract the most able persons into training programs and provide them with quality training in all four inquiry and inquiry-related functions in education. The impact educational RDDE will have on improving education will be dependent on the success of the training efforts.

Future RDDE Personnel Needs

A projection is, by definition, the carrying forward of a trend into the future. To make projections of manpower demand, one may look at financial trends and transform money figures into personnel figures, or one may ignore the financial aspect and look simply at the perceived need for personnel at some future point in time. Studies of manpower supply and demand in educational RDDE have been conducted in both ways; this section includes those studies relating to the demand for trained RDDE personnel.

Clark and Hopkins (1969) present the only projection of demand based on financial data. Their intent was to determine the amount of money which would be available to support RDDE personnel in 1974. Then, based on the assumption that the amount of money available for RDD would determine the number of persons who would be employed in RDD, a projection was made of the number of RDD professional staff members who would be needed by FY '74.[16] As mentioned earlier in this paper in the description of the Clark-Hopkins study, three projections were made: a least optimistic projection, a most optimistic projection, and a most likely projection. The smallest number of personnel which would be needed by FY '74 according to Clark and Hopkins was 12,827; they estimated 27,015 as the maximum which might be supported in 1974. The most probable number of RDD personnel who would be needed and could be supported was estimated at 19,436. This last figure represents almost a five-fold increase over the number of members in the educational RDD community which Clark and Hopkins said existed in 1964. However, other data cause at least mild doubt about the accuracy of the Clark-Hopkins projections. One can note that the total number of vacancies listed with the AERA placement service (Goodwin and Worthen, 1970) fell from 769 in 1968 to 459 in 1969 and to 412 in 1970.

It should be emphasized that the Clark-Hopkins projections were based on the assumption that the ". . . major political, social, and economic trends of the recent past will . . . continue" (Clark and Hopkins, 1969, p. 120). Viewed from the vantage point of late 1971, it can be seen that that assumption has not held. Hopkins, in the preceding chapter of this report, makes a new projection of 8,669 persons needed by FY '74, based on current funding patterns. This is considerably below even the least optimistic of the earlier Clark-Hopkins projections.

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[16] As in the Fleury study (1968), evaluators were not differentiated in the Clark-Hopkins report. They most likely were grouped with either the researchers or the developers.

Clark and Hopkins not only projected a dramatic increase between 1964 and 1974 in the numbers of RDD personnel, they also projected a marked shift in the functions of those personnel. Whereas in 1964 the proportions of research, development and diffusion personnel were 95.6%, 3.2%, and 1.2%, respectively, by FY '74 those proportions were projected to be 33 percent for research, 50 percent for development, and 17 percent for diffusion.

There is some supporting evidence in the AERA placement service data that the need for developers is in fact increasing. At the AERA placement service, "Although applicants for positions in development continue to outnumber vacancies . . . there are some bits of information which suggest that development is emerging as a more important and larger occupational area than was previously true. . . . It was noted that there was a modest increase in demand in 1970 for persons having competencies in educational development, curriculum development/analysis, and instructional media/techniques" (Goodwin and Worthen, 1970, p. 50).

There appears to be no support at this time (at least in the AERA placement service data) for the Clark and Hopkins projection that the need for diffusers will increase about 14 times from 1964 to 1974. Indeed, ". . . diffusion as an area of competence essentially was ignored by employers and applicants over the two years examined" (Goodwin and Worthen, 1970, p. 20).

It was found in the analysis of AERA placement service data (Goodwin and Worthen, 1970) that there seems to be an oversupply of applicants with research skills (e.g., educational research, research design, testing/applied measurement, statistics). This is not surprising in view of Fleury's (1968) finding that 94.1% of the graduate research training programs are training personnel to fill research positions. However, the oversupply was by a factor of about four and one-half and would indicate that training in these areas might profitably be reduced by 80 percent, not eliminated, as seems the case in the present shift of Federal priorities.

There is some support in the placement service data (Goodwin and Worthen, 1970) which may indicate that Clark and Hopkins were correct when they projected that the demand for research personnel would decrease. "In 1968 . . . 24.8 percent of the vacancies required competency in research methods/types, while this figure dropped to 12.3 percent of the vacancies in 1970. . . . The overall decrease in measurement from 13.6 percent to 7.9 percent was particularly evident in the research-related and research-facilitative categories. A dramatic reduction also occurred in the percentage of vacancies requiring competence in statistical analysis (11.8 percent in 1968 to 2.1 percent in 1970)" (Goodwin and Worthen, 1970, pp. 19-20).

In terms of over-all RDDE supply-demand trends, some information is available from non-financially based supply-demand data, such as that available from the AERA annual employment service. For example, although the number of applicants per vacancy in research and research-facilitative categories decreased from 2.03 applicants per vacancy in 1968 to 1.79 applicants per vacancy in 1970, ". . . the AERA employment service data seem to contain early indicators of what could develop into a 'depressed job market' situation. For example . . . it can be noted that applicants outnumber vacancies in all three categories (directly related to, facilitative of, and not related to RDDE). Additionally, fewer transactions are occurring on the job market; the absolute numbers of both vacancies and applicants are down. In comparing the 1968 and 1970 data, this is particularly true for vacancies (769 to 412) and less pronounced for applicants (811 to 727)" (Goodwin and Worthen, 1970, p. 48).

Looking at demand only, four studies have been conducted in which data are presented on the perceived need for trained RDDE personnel in specific geographical regions. Bargar and Hagan (1970), in their survey of public school administrators in Ohio, found that those administrators responding to their questionnaire on personnel needs were quite positive in their interest in and support for the undergraduate research training program at the Ohio State University. In answer to the question "Do you feel that graduates [of the undergraduate research training program] would be able to qualify for positions in the research, development, or evaluation activities of your department or district?" affirmative responses were given by 76 percent of the respondents in large districts, 80 percent in medium districts, and 80 percent in small districts. However, when asked "Do you have positions now open for which graduates of this program might qualify?" 73 percent of the large districts, 75 percent of the medium districts, and 90 percent of the small districts responding answered "no." In answer to the question "Do you anticipate any openings for 1969-70 for which graduates of this program might qualify?" 56 percent of the large districts, 100 percent of the medium districts, and 83 percent of the small districts responding answered "no." Thus, it seems that although the administrators would like to have trained RDDE personnel employed in their districts, there appears to be little real demand for (or little money to support) such personnel to assume actual positions. The stringent financial situation which caused Hopkins to revise his earlier projection downward from 19,435 trained RDDE personnel in FY '74 to 8,669 very probably is a significant factor in the lack of positions available in the Ohio public schools as well.

The Ohio State proposal (1970) included the results of a survey of manpower needs in Regional Educational Laboratories. One of the questions in that survey asked REL directors for their estimate of the percentage increase by 1980 in the employment of educational development specialists in R and D centers, RELs, public schools, universities and colleges, private research institutes, medical institutions, military institutions, business and industrial concerns, state education agencies, and the USOE. As a basis for the estimate, each REL director was asked to assume that each of those categories of agencies presently employs 100 educational development specialists. The mean percentages reported in answer to that question ranged from a 78 percent increase in the number of educational development specialists likely to be employed by medical institutions to a 600 percent increase in the employment of such personnel in the RELs. The percentage increase in six of the ten institutional settings (R and D Centers, public schools, universities and colleges, private research institutes, state education agencies, and USOE) ranged from 120 percent to 310 percent. Three institutional settings ranged from 78 percent to 83 percent.

The REL directors were also asked to estimate their needs for educational development specialists in their own agency in 1975 and 1980. By 1975, the directors estimated there will be a 131 percent increase in the number of doctoral level development specialists (from the 16 presently employed to 37). By 1980, they predicted a further increase of 68 percent to 62 doctoral level development specialists. At the master's level, the directors predicted by 1975 a 100 percent increase (from the 23 presently employed to 46) and a further 43 percent increase (to a total of 66) by 1980.

Interviews conducted by Ohio State personnel also yielded data on the number of full time equivalent RDDE personnel perceived as needed by 1975 in the agencies included in the consortium group. Representatives of agencies said that in 1975 there would be a need for 268 doctoral level RDDE persons (an increase of 135 over the number presently employed) and 392.5 (FTE) master's level persons (an increase of 226.5 over the current number employed). It should be noted again that it is unclear how these numbers were reached for the entire consortium group when it did not appear from the proposal that every consortium agency was represented by an interviewee.

In the Far West Lab's study, the 34 organizations in the northern California area presently employing RDDE personnel reported that they would likely need an additional 129 persons at the doctoral and master's level by 1971-72. This finding led the proposal authors to state that "These results are preliminary, but they obviously suggest that the market for trained personnel is substantially larger than might be estimated if only a narrow concept of 'educational' R and D is taken" (p. D10, Vol. 2). The under-estimates made by others are especially true in the business and industrial sector, in the opinion of the Far West Lab. The caution issued earlier regarding the Far West Lab's use of the term "educational RDDE" should be repeated here.

Estimates are made in the training proposal submitted by the Upper Midwest REL (UMREL) for the need for RDDE personnel at the professional and supervisory levels (Ph.D.and M.A. levels) in school districts, state departments of education, and state intermediate units in the 5-state region of Minnesota, North Dakota, South Dakota, Wisconsin, and Iowa. Those estimates for the number of RDDE personnel needed by 1972-73 are: 2,526 in school districts, 144 in state departments of education, and 228 in state intermediate units. No figures are given for current employment of RDDE personnel in these agencies, so no statement may be made concerning the amount of growth perceived as likely to occur. Little information is provided in the proposal on how the estimates were made, other than to say that the project staff, with the aid of the Minnesota Department of Education, compiled the information and made the estimates. Due to this lack of information, the estimates lose some of their credibility.

The UMREL report also included some generalizations about the number of RDDE personnel likely to be needed at colleges and universities in the five-state region, but they appear to be rather weak. The only way one may estimate from these UMREL data the future need for RDDE personnel in universities and colleges is by multiplying the number of colleges in the region in each category they list (e.g., junior college, university) by the estimated staffing level they list for that type of college by 1973. The authors of the proposal fail to give an estimate of the staffing level in the university category, however, saying that the estimated staffing level of RDDE personnel depends on the size of the university. While this is no doubt true, without further information it is impossible to estimate the need for trained personnel in this category -- likely the category employing the greatest number of RDDE personnel in education. Without the inclusion of the number of RDDE personnel needed by the universities, this REL's estimate of personnel needed in institutions of higher education (177 in 1973) has little value for the purposes of this chapter.

In attempting to summarize the information presented in this section of the paper, the one central thread which runs through the results of all the studies is the equivocal nature of the data reported. Collectively, these data do not provide much guidance for the trainer of RDDE personnel. In the Clark and Hopkins (1969) study, the manpower projections (of a need for between 12,000 and 27,000 RDDE personnel in 1974) were based on a range of anticipated funding levels which failed to materialize, thus invalidating all three sets of projections. Hopkins updated the original projections on the basis of new estimates of future funding levels, resulting in an estimate of 8,669 RDDE personnel needed in 1974 (see Chapter VI). Although this estimate is believable, it suffers from two serious inadequacies: (a) it is not coupled with any indication of how many educational RDDE positions or persons presently exist, making it impossible to determine whether we currently have more or fewer than 8,669 persons employed in the field, and (b) Hopkins was unable to break out functional emphases in his revised projections, thus providing no information on the relative emphasis that should be placed on training for research, development, diffusion, or evaluation.

The AERA placement service data (Goodwin and Worthen, 1970) provide some data which suggest that the RDDE market (at least during 1968-70) was glutted, with applicants far outnumbering vacancies in educational RDDE. However, these data are limited by at least three factors: (a) the locale of the annual conventions may have been a significant factor in determining who used the employment services, (b) there is no way of knowing whether the proportion of vacancies and applicants registered with the service is representative of the comparable national proportions in the educational RDDE market, and

(c) even if (a) and (b) above were resolved, the data represent a snapshot in time which provides little guidance to the person developing training programs for the future.

The several studies of perceived manpower needs in various regions suggest that many persons see a need for considerably more RDDE personnel than are employed in educational agencies at present. However, lack of clarity as to how data were collected or estimates were made and differing definitions of educational RDDE render further synthesis of these data hazardous if not impossible. In the one survey (Bargar and Hagan, 1970) where respondents were asked whether or not they actually thought additional positions for RDDE persons would or could be provided (as opposed to whether such positions would be helpful), the results were anything but optimistic. This creates some question as to whether similar attrition would result in the other "need-based" estimates if reality checks of this type were imposed on those estimates.

One thing which might be said with some degree of certainty (although not specifically as a result of data presented herein) is that future manpower needs will be tied much more directly to funding levels for educational RDDE than to educationists' perceptions of how many RDDE personnel are needed. In other words, funds will determine demand for RDDE personnel in education. At the present time, it seems doubtful that there will be a marked change in the near future in the amount of money available for educational RDDE. If the proposed National Institute for Education does come into existence, then a rapid infusion of funds into the research field is likely. However, as with the passage of the ESEA, creation of the NIE may result in a large amount of money being available for two or three years, but then, if it does not appear that the NIE is accomplishing its goals, funds may be cut off partially or even completely. Thus, based on past experience with the Monte Carlo characteristics of Federal funding of educational RDDE, it is most difficult to project likely funding levels for RDDE activities.

In summary, the current data on future supply and demand of educational RDDE personnel are simply much too shaky to support any firm projections; indeed, they defy any meaningful synthesis. Carefully controlled studies of educational RDDE manpower needs and supply are necessary before any real direction can be provided to trainers of RDDE personnel.[17] In the absence of such studies, trainers of necessity will have to combine their best interpretations of data such as those discussed in this section with judicious use of the crystal ball to determine how many and what type of personnel should be trained in educational RDDE.

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[17] Paul Hood, of the Far West Regional Educational Laboratory, is currently designing a study of educational RDDE personnel which promises to yield much valuable information in this area.

CHAPTER VIII

A SYNTHESIS OF THE RESULTS OF RESEARCH ON THE TRAINING OF RESEARCH AND RESEARCH-RELATED PERSONNEL IN EDUCATION

A SYNTHESIS OF THE RESULTS OF RESEARCH ON THE TRAINING OF RESEARCH AND RESEARCH-RELATED PERSONNEL IN EDUCATION[1]

There is an increasing number of research investigations dealing with the training of personnel in educational research, development, diffusion and evaluation (RDDE). To the present time, however, the studies have been unrelated in any programmatic sense and the results appear to be fragmented and collectively impotent in guiding trainers of RDDE personnel. In formulating its objectives for the current project the AERA Task Force on Research Training was convinced that the results of studies relating to similar variables important in RDDE training could be integrated into more applicable knowledge than would any of the studies viewed individually. The Task Force therefore set as one of its objectives to ". . . synthesize extant studies of educational RDDE personnel or studies of variables directly related to training such persons" (Objective 6). Generalizations drawn across studies might well offer valuable insights into the training process and lead to the formulation of exemplary training programs.

In order to draw such generalizations, it would be necessary first to identify relevant studies, to examine them for common themes, and to synthesize their results and the conclusions drawn from them. Such a procedure is perilous, however, if there is doubt about the truth or accuracy of the findings or conclusions of any one study which contributes to the synthesis. The credibility of each study therefore must be established before its results can be included in the synthesis.

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[1] The guidance of Dr. William J. Gephart in the effort reported in this chapter is gratefully acknowledged. In particular, his assistance in synthesizing judgments of the studies and in deciding which studies should be included in the synthesis was of great value.

The purpose of objective 6 was to collect and organize research studies having direct relevance to the training of personnel in educational RDDE, to subject the relevant studies to tests of methodological adequacy by expert judges of research quality, and to integrate the findings and conclusions of those studies which stood the test. The procedures followed to identify, describe, and judge the relevant research studies are outlined in the following section. The procedural description is followed by a synthesis of the results of those studies which were judged to be methodologically sound.[2]

PROCEDURES

The procedures followed in the review and critique of research are discussed under the following headings:

(1) Identification and collection of research studies.

(2) Determination of the relevance of each study to RDDE training variables.

(3) Description of the relevant studies.

(4) Development of criteria for testing methodological adequacy.

(5) Judgment of the relevant studies.

Identification and Collection of Studies

Standard library search procedures were utilized by the Task Force staff. A list of key words was prepared with the intent of setting the broadest possible limits for the identification of relevant studies. Psychological Abstracts, Sociological Abstracts, the Education Index, Current

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[2] The actual abstracts of relevant studies and the specific conclusions reached during the judgment process were originally presented in Technical Paper No. 27; they are not included here. The research studies which are included in the synthesis section of this chapter are listed in Appendix O to this report.

Index to Journals in Education, and Research Studies in Education (keyed to Dissertation Abstract International) were reviewed for titles and abstracts that had potential relevance for this review. The Science Information Exchange, as well as the ERIC system, were also utilized. The bibliographies from studies known to be important works in the area were obtained and reviewed for any additional titles that should be included.

Approximately 275 titles were identified. Of these, approximately 150 articles, books, and manuscripts were discarded because they were not data-based studies or because the content was subsequently determined to be unrelated to RDDE training.

The remaining 125 studies were requested from authors, or obtained from the University of Colorado library system or from University Microfilms. There were 15 potentially relevant studies which were not obtained due to the failure of the author to respond in the required time or the lack of availability of the works from the library system or the inter-library loan service. (Example of potentially relevant studies not collected were Chamberlain, 1971; Schalock, 1970; Davis, 1962; and DiLorenzo, 1967.) The remaining studies were read, described briefly and subjected to analysis by staff members according to the inclusion criteria developed for this project.

Determination of Relevance

Each study identified was subjected to the following criteria:

1. Studies must show some evidence of data collection and reporting. The sizable number of position papers identified were thus excluded from consideration. Examples of such position papers are Stanley (1966) and Kerlinger (1965). Exceptions to this criterion were made for works by Gideonse (1969) and Bargar (1967).

2. Program evaluations are excluded. The author must intend that his findings be generalizable beyond a single program. Because of this criterion, evaluations of ESEA Title IV training programs were excluded from consideration.

3. Studies must be relevant to variables related to training of RDDE personnel. A system of categories was developed which permitted each study to be classified according to its degree of relevance for this project. The four categories are discussed below.

Category 1: Studies relating *specifically to the training of RDDE personnel* in education formed the most directly relevant group. Examples of studies falling into this category are Worthen and Roaden (1971), Fleury (1968), Fields (1971), and Sieber (1968).

Category 2: The next most relevant group consisted of those studies investigating *training variables of RDDE personnel in the related areas of the social and behavioral sciences*. Examples fitting in this group are Clark (1957), Sibley (1963), and Fiedler (1968).

Category 3: The third category delineated by the staff consisted of studies of *educational RDDE personnel themselves* (not of their training *per se*) including manpower studies and investigation of the setting in which educational RDD and E takes place. Examples here are Persell (1970), Sieber and Lazarsfeld (1966), and Clark and Hopkins (1969).

Category 4: This category was made up of studies investigating *researchers in related areas*. Parts of Clark (1957) and Sibley (1963) fall into this group.

4. Outside the core of studies identified in (3) was a large number of books and reports, some parts of which are relevant to RDDE training variables. The decision to include or exclude each document was made by consensus of three staff members based on an extensive reading and summarizing of the document by one of the staff. The decision criteria concerned three general areas:

   a. Information in the study must be sufficiently specific to RDDE personnel: i.e., it must break down categories of "educational personnel" into more specific categories such as "educational research personnel." Studies dealing with graduate students in all fields of education (with sub-area unspecified), such as Kidd (1959), were thus excluded. The same distinction was adhered to in considering studies of personnel in related fields.

   b. The variables studied must be directly related to training, or inferences must be fairly direct between the variable studied and RDDE training. There must be some possibility of control over the training variable in order for that variable to be considered for inclusion. Studies which dealt with creativity, such as Torrance (1964), as well as "environmental press" studies such as Thistlethwaite (1963), were thus excluded.

   c. The proportion of relevant findings in the report to total number of findings must be sufficient to warrant the sizeable commitment of resources involved in describing and critiquing

> the total study. That is, if there was only one relevant finding in a group of 38 findings in a large study, it was decided that the adequacy of the entire study would not be assessed just to determine whether or not that one finding should be included.

The rationale for these criteria relates to the need to deal in depth with the most directly pertinent studies of training variables and to screen out from the "knowledge base" those studies which are only tangentially related.

Description of Studies

Those studies which satisfied the inclusion criteria were assigned to Task Force staff members for description. These readers were either graduate students or faculty at the University of Colorado who designated research as a major or minor field of study. They were oriented to the purposes of this objective and trained in the use of the descriptive outline which had been developed.

The outline for description of each study included the problem statement, the statement of objectives, and the hypotheses or questions posed by the author. Data generation was described according to the population studied, the sample, the variables under study, the instruments or techniques used to collect data, the percentage of survey response (where appropriate) and descriptions of treatment variables (in the case of experimental or quasi-experimental designs). Data analysis was described in terms of the type of data generated for each variable (nominal, ordinal, interval or ratio), the statistical technique employed for each variable, and indications of errors in data reduction or analysis. A list of the author's findings was presented. These were defined as narrative statements of numeric outcomes and were accompanied by any indications found by the reader of inconsistencies between numeric and narrative productions. The conclusions reached by the author were presented last. Conclusions were defined for the staff members as those statements by the authors that interpreted or explained the findings of the study, as well as the generalizations drawn by the author. Some problems were encountered with respect to the conclusions since the above definition was not always consistent with those of the authors. Not all authors listed conclusions. Some so-called conclusions were simply restatements of findings, while others seemed to come more from the author's philosophical position than from the data he gathered. The readers were instructed to accept the conclusions which were listed as such by the authors. In cases where no conclusions were explicitly stated, the readers were instructed to list those statements from the text which seemed to explain, interpret, or draw generalizations from the findings.

Development of Criteria for Testing Methodological Adequacy

After a series of discussions among the Task Force and Task Force staff and investigations of various methods of evaluating research studies, the decision was made to use the methodology proposed by Gephart (1969) in "Profiling Instructional Package," a Phi Dalta Kappa occasional paper. The method proposed consists of the profile of the various "elements" of the research process: the "inherent logical argument" of the investigation, the "selection of subjects to be studied, structuring of experiences for those subjects, measurement related to those experiences, and analysis of the collected data." Gephart makes the assumption that each element of a study must be evaluated separately since the methodology may be sound in some areas and weak in others.

Modification of the Gephart system was necessary for several reasons. First it was important to emphasize those aspects of the evaluation which pertained to survey research, since this methodology has been most often used by authors of research training studies. Second, the reasons for determining the methodological adequacy of these studies (i.e., deciding whether or not the study would be included in the synthesis of results) was idiosyncratic to this project and allowed de-emphasis of the conceptual, pre-data collection phases of the study. Last, through a series of discussions with experts in the field, it was found that evaluating the quality of research is often a subjective process in which the research methodologist brings to bear his accumulated knowledge and experience in order to arrive at an overall decision about the adequacy of the study. Therefore, it was decided that the profile of elements in the evaluation system should supplement rather than replace this process.

On the basis of these discussions two types of judgment format were prepared, one for status studies (normative, survey, correlational) and another for experimental (and quasi-experimental) studies. The elements of the format for status studies are given below along with the general evaluative criteria. (No studies which were classified as experimental or quasi-experimental were identified as relevant for this review.)

1. The Population of the study - (clear definition of the population and its appropriateness to the problem investigated)
2. The Sample studied - (the definition and the size of the sample as well as the representativeness of the sample to the population)

3. The Variables studied - (clear delineation and operational definition of the variables as well as the appropriateness of the variables to the problem investigated)
4. The Instrument or technique used for data collection - (the sufficiency of the instrument in terms of objectivity, reliability and validity)
5. Percentage of Response in survey studies - (the sufficiency of the return rate and the adequacy of non-response bias checks)
6. Data Analysis - (the appropriateness of the statistical techniques applied to each type of data as well as indications of errors in analysis that would alter the findings significantly)
7. Findings - (the accuracy of the translation from numeric outcome to narrative presentation; the determination of whether or not the findings were unequivocal)
8. Conclusions - (the determination of whether or not each conclusion is a logical and justifiable interpretation or explanation of the data and whether or not the conclusion is warranted by the findings of the study)
9. General Comments and Recommendations of the judges regarding inclusion or exclusion of the study for the synthesis of results.

In addition to these elements, several critical points were identified for the judges. If the study failed at any of these termination points, the judge was requested to terminate his evaluation. These termination points were the following:

a. if the sample of the study was both unspecified and undefined, so that the reader could not determine who was being studied, exclude the study;

b. if all data were analyzed by an inappropriate statistical technique, exclude the study;

c. if errors in analysis were serious enough to alter all the findings significantly, exclude the study, and;

d. if an accumulation of small problems or overall weaknesses caused the judge to doubt seriously the credibility of the findings, exclude the study.

Judgment of the Studies

The staff member who read and described a particular study was also the first judge for that study. Staff members were oriented to the purposes of this phase of the objective and trained in the use of the judgment format.

The outside experts who served as second judges on the studies all hold degrees in educational research or research-related areas and include nationally recognized experts in research methodology as well as several recent graduates of the University of Colorado, Laboratory of Educational Research (ESEA Title IV training program), where the training emphasis was on research methodology.[3] These outside judges were provided with the description of the study and (in most cases) the document itself, along with orientation to the use of the judgment format and the purposes of this phase of the study.

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[3] These outside judges were Nancy W. Burton, James R. Collins, Gene V Glass, William L. Goodwin, Arlen R. Gullickson, Kenneth D. Hopkins, Stephen G. Jurs, Perc Peckham, W. Todd Rogers, James R. Sanders, and Douglas D. Sjogren.

In a few cases there were disagreements between the first and second judges' recommendations concerning the inclusion or exclusion of a study. To resolve the disagreement, an expert in research and evaluation from the Colorado State Department of Education was called upon to act as a third judge to resolve differences between the first two.[4]

Finally, a member of the AERA Task Force synthesized the judgments made, summarized the judges' comments on the studies, and aided in the process of deciding whether the findings and/or the conclusions of each study should be included in the synthesis of results which follows.[5]

SYNTHESIS

Although the Task Force has been concerned with the training of all types of educational RDDE personnel, this synthesis deals almost exclusively with the training of researchers per se rather than the entire range of research, development, diffusion, and evaluation personnel. This is not a denigration of the other roles; rather, it is a reflection of the focus of existing studies on the training of educational research and research-related personnel.

The knowledge base provided by research on the training of educational researchers has antecedents in several areas of research currently being pursued. Among these are studies of research quality, studies of research methodology, and manpower studies. A brief summary of the nature of research in these areas is given below, but individual studies will not be summarized.

Primary interest in this chapter is devoted to the area of research impinging directly on the training of educational research personnel. Studies in this area were subjected to the tests of methodological adequacy described above, and those which withstood the test are included in the present synthesis. The synthesis is presented in two sections, one which deals with researchers and the research setting, and one which deals with the research training process itself. The two sections of the synthesis immediately follow the summary of the nature of research in the background areas.

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[4] This judge was John P. Ahlenius, who received his training at CIRCE, University of Illinois.

[5] William J. Gephart served in this capacity.

The Nature of Research in the Background Areas

Studies of Research Quality

Broadly pictured, systematic studies of the training of researchers stem from concerns about the quality of the research effort. Published statements expressing this concern date back to 1923 (Brooks, 1923) and can be found with increasing frequency over the ensuing years. The Brooks article presents a set of criteria to be used in considering educational research and represents an attempt to improve educational research by providing guidelines for use in designing research efforts. A slightly different approach is the analysis of the errors made in completed research. The earliest example of this is Wilson's (1934) effort. The purpose of studies in this category is to make recommendations on what research ought to be, based on a study of errors in prior research efforts.

The product of this line of inquiry is improved understanding of the general nature of the research process, and in turn the processes by which researchers ought to be trained. It has led to work by Gephart and Bartos (1969) who proposed that there exist in any piece of research five facets: an inherent logical argument, a representativeness facet, a measurement facet, a treatment facet, and an analysis facet. The authors propose that assessment of these facets is necessary to determine the validity of the research and to determine the confidence that can be placed in its conclusions.[6]

Studies of Research Methodology

The second line of antecedent research deals with the study of specific research methods and techniques such as the validity of a measuring instrument, the role of the "Hawthorne Effect," the role of Bayesian statistics, etc. This area of inquiry is one on which the training of researchers must depend, for it provides the specific content for the instructional program.

Although studies of both research quality and research methodology are important antecedents of the studies of research training, they do not deal with the training of research and research-related personnel *per se*. No further effort has been made to state in this synthesis what knowledge has been produced by these studies.

Manpower Studies

Studies which deal with the supply of and demand for personnel with capabilities in educational RDDE were included in the review of research reported in *Technical Paper No. 27*. A synthesis of the results of these studies is presented in Chapter VII above.

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[6] An example of this type of assessment is the approach used in determining the methodological adequacy of studies of research training contained herein.

Studies of Researchers and the Settings in which Research is Conducted

Educational research is done by people, individually and collectively, in an environment. The nature of the individuals and the physical and socio-emotional character of the environment affect the nature of the work done. Research in these areas attempts to identify the educational researchers, to describe them on selected variables, to characterize the institutions in which they work, and to assess their productivity. In assessing productivity, some information directly related to the effectiveness of training is produced. Research on the other factors described above provides related and supportive information but not direct statements about research training.

The values of educational researchers, their educational background, their employment positions, and the type of work they do are all important in understanding both the nature of the task for which researchers are being prepared and the means by which the desired expertise can be acquired. This does not imply that the goal of educational research training programs should be simply to reproduce the existing type of researchers for work within the existing institutional settings in which research is currently conducted. Rather, it is information which should be relevant as future training alternatives are delineated and assessed.

A notable problem was encountered in the attempt to synthesize findings from studies which describe existing researchers. Although the population purportedly was the same across the studies, different authors identified their groups differently. Buswell, et al. (1966), for example, studied those persons who had received their doctorate in 1954 and 1964 from schools or departments of education. Other authors identified their samples differently, sometimes including researchers from substantive fields outside education (Clark, 1957; Bargar, et al., 1965).[7] Some identified their samples by consulting directories of relevant professional associations (Worthen and Roaden, 1968) or by consulting the National Register of Educational Researchers as Worthen (1969) did. Still others used a combination of these methods (Bargar, et al., 1965). When the differences in sample identification are pertinent in understanding differences in the results of studies discussed in this chapter, they will be re-emphasized.

Demographic and Personalogical Variables

The following demographic and personalogical variables related to researchers have been studied: age, sex, geographic location, religion, socio-economic status, and personality traits. A synthesis of the methodologically adequate studies is given in the paragraphs below.

Age. The average age of the researchers studied by Bargar, et al. (1965) was 45 years while the average age of Persell's (1971) group was 41 years. The juxtaposition of these results gives the impression that the average age of the research group is decreasing over time. There are alternative explanations for this difference, however, one of which is the difference in defining the population employed by the two authors. This could be the case since Persell's group, by definition, was composed of productive scholars (authors of research reports), and (as noted below) such persons tend to be younger upon receipt of degree than researchers at large, which is more representative of the group Bargar studied. These findings relate to the age of researchers at the time they responded to the respective surveys. A related factor -- the age at which the researchers received their doctorates -- has been studied in several projects and is discussed below.

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[7] Persell (1971) documented the overlap between psychology and education in finding that psychology influenced educational research in both research methods employed and the problems selected for investigation.

Early entry into a research career appears to be positively related to productivity. Buswell, et al. (1966) concluded that those who received a doctorate by age 32 are more likely to be productive than those who received it at age 40 or older. They found further that those persons whom they identified as the most productive scholars[8] tended to have completed their doctoral degree before age 30.[9] This is consistent with Clark's (1957) conclusion that "significant contributors" to the field of psychology emerge early in their careers. Persell (1971) found that a greater percentage of researchers under the age of thirty were doing good quality research than was true for researchers aged 50 or older.[10]

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[8] Two different populations are referred to in the Buswell, et al. (1966) study. The first consisted of all those persons who received doctorates in education in 1954. These were divided into a productive (two or more research articles published in ten years) and a non-productive group. The second population was studied by Heiss and consisted of those thirty-one scholars who had contributed the greatest number of research articles in journals related to education and were selected on the basis of their judged contribution to the field. These will be referred to here as the "most productive" researchers.

[9] The reader is referred to a later section for consideration of productivity of researchers.

In addition to receiving the doctoral degree at a relatively early age, the most productive scholars publish research soon after their entry into research training. Buswell, et al. (1966) found that productive researchers tended to have published research before or within one year of the completion of the doctorate. More than half of those identified as the most productive researchers had published a research article or presented a paper at a professional meeting before completing the doctorate.

The collected findings appear to point in the same direction -- that those who receive their degree at a younger age are more likely to make contributions to the field through research. At the same time, other results indicate that, on the average, education doctorates receive the doctoral degree relatively late. Wilder (1966) found that the median interval between the bachelor's degree and the doctorate for persons in the field of reading was 15 years.[11] Assuming that the average age of persons receiving their bachelor's degree was 21 or 22, this would indicate that half of education doctorates receive their doctorate at age 35 or older.[12]

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[10] The reader is alerted to the fact that Persell's definition of research quality is somewhat different from many previous definitions. Typically, research quality has been operationally defined as the adequacy of the research methods and techniques (e.g., design, analysis) used by the investigator to produce unequivocal data. Such definitions of research quality result in the primary focus of assessment of quality being on freedom from methodological flaws and, consequently, on how much confidence can be placed in the results of a study. Persell asked expert judges to give three ratings to a piece of research based on its (a) contribution to theory, (b) contribution to practice, and (c) use of (or contribution to) research methods. The latter category overlaps with usual ways of judging research quality, while the two additional categories add the dimension of judging quality in terms of theoretical or practical significance. However, since two-thirds of the judges' responsibility was focused on what results from a study--i.e., the impact it has--it may be that there is relatively less emphasis on judging methodological adequacy than is true with narrower definitions of research quality where this is the sole focus of the qualitative judgment.

The discrepancy between the age at which most potential scholars in the field receive their highest degree and the age at which researchers are most likely to contribute is a significant matter. The inference could be made that education doctorates, being older at receipt of degree than persons in other fields, would ipso facto be less productive. The relatively late entry of educational doctorates into their careers and the possible interference of their pre-doctoral career experiences are related variables which will be considered together later in this chapter.

Sex. Bargar, et al. (1965) found that, of all persons identifying themselves as part of the educational research community, the large majority are males. This is consistent with Persell's (1971) conclusion that females are under-represented among researchers. Clark (1957) found that only 5 percent of the "significant contributors" to the field of psychology were females, while females account for 26 percent of the membership of the American Psychological Association. Wilder (1966) found that a smaller percentage of female "reading experts" become researchers than is true for males.

The under-representation of females among doctorates in education and related areas is consistent with their representation in other professions.

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[11] Wilder (1966) studied persons identified as experts in the field of reading. They were identified as experts by virtue of their training and degrees received in that field, as well as positions held or research conducted. They represent a subset of those with advanced degrees in education.

[12] A further question would be whether the age distribution is the same now as it was in 1966.

In contrast, it is of interest to consider the preponderance of females in fields of educational practice, as opposed to research. The issue of sex differences in personnel needs as expressed in vocation might be used to explain this anomaly of sex composition of the educational community. Differences in the role prescriptions, role demands, and role stereotypes that characterize the two areas of work must also be considered. Self-selection is another plausible alternative explanation of the sex composition of the educational research community. Conversely, another plausible explanation is that the sex differential can be at least partially explained by systematic exclusion of females from the research community. In the absence of an adequate empirical base, however, all the above statements must be viewed as conjecture at this point.

Persell (1971) found a relationship between research quality and sex which was quite different from the relationship between sex and research productivity just described. That author found that 39 percent of the females in her sample are doing good quality research, whereas this was true for only 29 percent of the males in her sample. The discrepancy between quality and productivity as it relates to sex is not necessarily a contradiction, for Persell studied a population which was productive (of at least one piece of empirical research) by definition. In another part of the same study Persell found no relationship between quantitative productivity and overall quality of research.

To summarize the research results on the sex variable, it can be said that the educational research community is predominantly male, with the male researchers also more likely than females to be among the productive members of the community. Considering only the productive persons, however, the female researchers are making proportionately more contributions to theory, educational practice, and research methods.

Religion, race, socio-economic status. Persell (1971) concluded that the population of researchers is more diverse in terms of religion than in sex or age. She found that the proportion of the researchers who are Protestant or Catholic is less than would be expected on the basis of the proportions of Protestants and Catholics in the population as a whole. The percentage of whites among the researchers was 97 percent. Persell also concluded that "the socio-economic status of the researcher's family had no striking relationship to research quality" (Persell, 1971, p. 228).

Geographic location. In examining the portion of the country from which researchers have come, Bargar, et al. (1965) found that the majority of individuals had come from the heavily populated northeast and north-central states extending from Missouri and Minnesota to New Jersey and Massachusetts. In her study of researchers, Persell (1971) concluded that more had come from the midwest than from any other region. These two regions, of course, overlap to a large extent.

Personality traits. Buswell, et al. (1966, p. 87) reported that in terms of development of research interest, the most productive group of scholars "... had numerous early interests of an inquisitive nature and had pursued these interests systematically and independently." Their range of outside interests was broad. They were characterized as having a high level of theoretical orientation and autonomy as well as the ability to deal with complex ideas. Persell (1971) noted that research quality is related to intellectual orientation, which she described as being intellectually curious about substantive questions in a scientific field.

Academic Training and Career Experiences

The academic training and career experiences of researchers have been surveyed in several studies. Attempts have been made to relate these experiences to the subsequent contribution of the researchers.

Undergraduate training. About half of the researchers studied by Bargar, et al. (1965) had majored in education as an undergraduate. As might be expected, a larger proportion (70 percent) of those reading experts studied by Wilder (1966) had an undergraduate major in education. Half of the significant contributors to the field of psychology had majored in that field as undergraduates (Clark, 1957).

Concerning the undergraduate experiences associated with subsequent productivity, Buswell, et al. (1966) found that productive researchers (those education doctorates who had published two or more research articles in ten years) were more likely to have received undergraduate degrees from institutions which have doctoral degree programs. In comparing education doctorates who are productive with those who are not, only one difference in undergraduate major was found. Those who majored in psychology were more likely to become productive of educational research than undergraduate majors in other fields. A negative relationship was found between the number of undergraduate education courses taken and later productivity. The most productive researchers (Heiss, in Buswell, et al. 1966) usually had a liberal arts undergraduate major.

It would be possible to juxtapose these findings and conclude that, while educational researchers as a whole are likely to have undergraduate backgrounds in education, those who turn out to be productive are from liberal arts programs. Recruitment of potentially more productive personnel, therefore, should be aimed away from education-trained people. Such a conclusion fails to consider the fact that the productive researchers studied by Heiss were a highly selected group of scholars both in education and in related disciplines, who had published a large number of research articles of concern to education and were selected on the basis of their pre-eminence in the field. Although one should not infer that all educational researchers ought to be drawn from liberal arts backgrounds, it appears that those persons are likely to achieve pre-eminence in greater proportions than those with undergraduate education backgrounds. Clark reported that of his "significant contributors" three out of four reported being in the top five percent academically of students in their respective majors.

Graduate training. In their study of all persons who wished to identify themselves with the educational research community, Bargar, et al. (1965) found that at the doctoral level, the most common major was education; however, education surpassed psychology by only a small percentage. It was found that the majority of respondents did not receive their primary training in research methods per se. For those who specified a subfield of their major, the most common subfields, in descending order of frequency, were: educational administration, educational psychology, and educational subject areas. In another study, Wilder (1966) found that 92 percent of his reading experts received their doctorates from departments of education.

The relationship between advanced degree major and research productivity has also been investigated. Buswell, et al. (1966) reported that graduate education majors are no more or less likely to become productive researchers than persons who have majored in any other field. According to Persell (1971), education doctorates are just as likely as behavioral science doctorates to be productive, providing they have had research experience as a graduate student.[13] Among those scholars who are oriented to research, Persell found that behavioral science doctorates are more likely than education doctorates to be contributing to theory, but no more likely to be contributing to educational practice or to the use of research methods.

The specific experiences of the researchers during their graduate training have also been investigated. Those relating specifically to research apprenticeship experiences are discussed in a later section; all others are discussed here.

Buswell, et al. (1966) concluded that working for a doctorate in education was largely a part-time pursuit while holding a full-time job, usually in schools. They also found that productive researchers and non-productive researchers were significantly different with respect to the number of months they had spent in continuous full-time residence, with productive researchers spending more time in residence. When all doctorates studied were viewed together, it was found that a large proportion (69 percent) had a lapse of six years or more between their initial enrollment in doctoral studies and the completion of their doctoral degree. This phenomenon is not limited to those in education. Clark (1957) found that for the "significant contributors" in psychology, the median lapse between the B. A. and the Ph.D. was four years, while for psychologists in general that lapse was about eleven years.

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[13] This relationship is not surprising; graduate research experience seems likely to lead to later research more often than non-research experiences, regardless of departmental affiliation of the graduate students.

In terms of the institutions where graduate training was conducted, information from Bargar, et al. (1965) shows that at the time of their study (1964) state universities accounted for slightly over half of all highest degrees obtained. Buswell, et al. (1966) found that the most productive scholars in the field earned doctoral degrees at Harvard, Columbia, Chicago, Minnesota or Ohio State.

In summarizing these findings, it appears that the undergraduate and graduate training of educational researchers is divided among the disciplines and is not exclusively the job of education departments. Education departments do produce a greater proportion of educational researchers than does any other department. No unequivocal support can be found for systematically favoring training in one discipline over another in effecting greater subsequent research productivity (although there is some support for viewing undergraduate majors in psychology as potentially more productive of research). Of those who have been trained in education, however, relatively fewer approach graduate training immediately after receiving their bachelor's degree or pursue it continuously, two factors which are positively related to subsequent productivity.

The type of doctorate. Although the Ph.D. is often described as a research degree and the Ed.D. identified as a professional degree, the empirical evidence from several studies dealing with the actual differences between the two is unclear. For example, Bargar, et al. (1965) found that 58 percent of his self-designated group of educational researchers had the Ph.D. and 23 percent had the Ed.D. These figures were not cross-tabulated, however, with the field or department in which the degree was obtained. Therefore, information to compare the proportion of Ed.D.s among all education doctorates with their proportion in the research community is lacking. One can draw some inferences from the simple frequencies presented by Bargar and his colleagues. They report that of the 3216 persons in their analysis group who held doctoral degrees, 915 held the Ed.D. and 2296 held the Ph.D. They also report 1432 doctoral degrees in education. Although no cross-tabulation is provided, it is reasonable to assume that all 915 Ed.D. degrees are held by persons in education, leaving only 517 doctoral degrees of other types -- probably almost exclusively Ph.D. -- in the education group. Thus, of the education doctorates in Bargar's group of researchers, holders of Ed.D. degrees outnumber holders of Ph.D. degrees by almost two to one, raising questions about whether the Ph.D. is really more of a research degree than the Ed.D. Without knowing the relative frequency of the two types of degree in the field of education as a whole, however, the frequencies in Bargar's group cannot be interpreted meaningfully. On the surface, it appears that data from the Buswell, et al. study (1966) could be used to establish a basis for comparison of proportions of degree type in the field. Comparison with the proportions in Buswell, et al. (1966) is difficult since certain subspecialties were categorized differently by the two authors. For example, Bargar, et al. (1965) categorized those persons who had majored in educational psychology under the general heading of psychology. Many of these same persons actually received doctorates in departments of education and would have been classified in education by Buswell, et al.(1966).

Buswell and his colleagues concluded that differences in the type of research methodology employed by Ph.D. and Ed.D. candidates in conducting their dissertation research were not large. In this study also, the biggest differences in research were between field majors rather than types of degree. In terms of subfields within education, Buswell, et al. (1966) found that more people in the area of educational psychology were researchers than non-researchers, while for persons with a doctorate in educational administration the situation was reversed. Other subfields of education showed less difference in the percentages of persons in the research and non-research groups.

There are counter examples of this trend to minimal differences among holders of the two degree types, however. Buswell, et al. (1966) reported that 20 percent of the Ph.D. holders were categorized as productive, while 7.8 percent of the Ed.D. holders were in the productive category.[14] Another counter example is provided by Persell (1971) whose findings suggest differences by degree type, although the relationship did not apply when the holder of the Ed.D. had selected career research experiences and was oriented to research (as indicated by his stated preference of research over teaching and administration).

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[14] The authors reached no conclusions relating to this finding since degree type was used as a categorization variable, and no significance tests were employed to determine if these differences in productivity were significant. The percentages reported above were merely presented in tabular form.

The evidence on this issue is equivocal and requires further study. Such study might well investigate whether the training received by holders of the two types of degree differs (i.e., do Ph.D. candidates systematically receive more training in research than do Ed.D. candidates) or whether students select for themselves the degree type which fits more closely their prospective professional role.

Professional Experience

The interaction between graduate training variables and variables related to professional experiences deserves attention at this point. Two studies have been concerned with this interaction. Buswell, et al. (1966) found a negative relationship between teaching experience and research production. Persell (1971) defined a variable, "practice-oriented socialization," as the graduate training or career experience which would prepare a person more for the role of educational practitioner than for the role of researcher. She found a negative relationship between this variable and her definition of research quality.[15]

Worthen (1969) analyzed the career patterns of existing researchers (based on data from Bargar, et al., 1965). He found that these researchers had commonly entered research positions or begun research activities following occupations in a variety of roles in professional education.

The set of results in this section again illustrates a conclusion already posed--contribution to research is associated with certain personal or professional characteristics and those persons who are doing educational research possess those characteristics more often than educationists who do not participate in research processes. Information relating to these characteristics has obvious import for recruitment into research training programs or careers.

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[15] Sieber and Lazarsfeld (1966) came to a conclusion which on the surface appears related. This is the conclusion that the requirement of professional experience is negatively related to the productivity of researchers in an institution. This latter variable, however, is defined as institutional productivity in terms of numbers of persons who go on to be researchers and does not relate to subsequent productivity of the individual researcher.

Employment. As of 1964, the majority of persons who indicated they were doing research in education were not employed primarily as researchers (Bargar, *et al*., 19[illegible]. Over 50 percent of the respondents were employed in education, with psychology a close second and sociology a distant third. Among subfields of education, educational administration was the largest single category of employment. Fewer than 20 percent of all persons described in this study as educational researchers were in subfields of education which are primarily concerned with research. Similarly, Puffer (1967) found that deans of education indicated that they intended to hire only limited numbers of faculty members with educational research assigned as their principal function. Worthen and Roaden (1969) reported that only 23 percent of the AERA members they surveyed held a position which was primarily a research position. This clearly points to educational research as a part-time activity, with limited financial support devoted solely to such pursuits.

The majority of educational researchers in 1964 were employed in colleges and universities (Bargar, *et al*., 1965). Within this setting, only 7.8 percent were employed in units identified as being primarily research units. It was found that 75.5 percent of the researchers were employed in university and college units in the field of education. Bargar and his colleagues concluded from this and other findings that almost a quarter of those persons who identify themselves as part of the educational research community have their training and subsequent professional identification outside the field of education.

The rather large proportion of Bargar's group of educational researchers who are employed in departments of education makes important the examination of these departments for their research capabilities. Puffer (1967) studied all institutions offering a bachelor's degree in education.[16] He found that about 22 percent of the faculty members of education departments, schools, or colleges qualify as researchers according to their dean's rating of their academic preparation in research methodology and involvement in research activities. Membership in research associations is held by only about 17 percent of all education faculty members. Based on these results it is possible to pose an hypothesis. By virtue of their background, training and commitment to the field, those persons employed in departments of education should be the primary pool of persons performing independent research in the field of education. The majority of these persons, however, spend small proportions of their time in research activities, and otherwise give indications of little direct commitment to research (e.g., a majority fail to meet the criteria which Puffer used to qualify persons as researchers). Most education professors are probably more committed to, and absorbed by, activities which contribute to the improvement of educational practice -- such as teacher training. Fortunately, significant numbers of persons outside the discipline of education are interested in contributing to educational research.

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[16] The findings of this study are probably biased toward the large institutions, with small institutions under-represented.

Further study has been made of the employment setting of educational researchers. Buswell, et al., (1966) concluded that in view of the proportion of researchers in academic settings, the major universities offer the best opportunity for post-doctoral research. They also noted the small number of researchers holding positions in public schools at the time their study was conducted. In addition, it was concluded that ". . . while there are marked differences in the cases of a few outstanding private institutions, for the country as a whole, the amount of educational research done in public institutions as compared to private institutions is quite impressive" (Buswell, et al., 1966, p. 28).

Persell (1971) found that persons employed in either universities or specialized agencies were more likely to do research which contributes to theory, practice, or research methodology than those in other settings such as research units in public schools or state departments of education. This could be accounted for by the relatively greater preference for research activities over other professional activities among those persons who work in universities and research agencies. She also found that prestige of the department in which the research is conducted relates differently to type of research contribution in various departments. For example, while greater departmental prestige is related to better contributions to theory and research methods in behavioral science departments, in education departments greater prestige is related to greater contributions to educational practice. This point again emphasizes the hypothesized contrast between orientation to educational practice and to educational research.

Professional Work of Researchers

The professional work of researchers has been investigated in the following related areas: their research involvement (time spent in research), their research productivity, the quality of their research, their identification with professional specializations, and their affiliation with professional associations.

Research Involvement. When studying the amount of time devoted to various professional activities by self-nominated members of the educational research community, Bargar, et al. (1965) found that most members of the sample identified had spent some time in research. However, much less time was devoted to research than to administration, teaching, or other activities. Half of the sample spent 20 percent or less of their time in research. Of the AERA members surveyed by Worthen and Roaden (1968), the mean percentage of time spent in research was 18 percent, and the median was 10 percent. Only 37 percent of the respondents spent as much as one day per week in research. About 10 percent were found to engage in research administration and about 20 percent were found to be teaching courses in research methods. Buswell, et al. (1966) also reported that a small percentage of time was spent in research by their sample of education doctorates. They concluded that "In view of the limited time devoted to research, it is not surprising that the total output of research publications is so small" (Buswell, et al., 1966, p. 35).

The nature and demands of the positions held by professionals in education and related areas probably imposes a restriction on the number of hours that potentially could be devoted to research. Clark (1957) found this to be true for the psychologists whom he studied. Wilder (1966) found that among reading experts the bulk of time was spent in teaching, preparing classes, and counseling. The remaining activities, including research, tended to be done on a part-time basis.

While the results of other studies point to a small degree of research involvement among educational researchers, Persell (1971) found that 72 percent of the group she studied were spending more than 20 percent of their time on research. Forty-eight percent of her sample indicated that research had been their primary activity for some six month period, although only nine percent were full-time researchers. In terms of their commitment to research, Persell found that those who ranked research higher than other professional activities were also those who tended to produce research of high quality.

Population differences doubtlessly account at least partially for this large discrepancy between the research involvement of Persell's sample and that of the other samples mentioned previously. Persell began by identifying her sample from those who had published an empirical study, people who by definition were productive of research, and therefore more likely to spend time in research activities. With this counter-example thus qualified, the conclusions seem to point clearly to the fact that most persons who might be contributing to educational research tend not to spend much of their professional time in research activities. Full-time educational research positions appear to be a rare phenomenon.

Research Productivity. Buswell, et al. (1966) used two or more publications in ten years as the criterion for defining "productive researchers." According to this criterion, 20 percent of the Ph.D. holders and 7.8 percent of the Ed.D. holders qualified as productive. Wilder (1966) found that 51 percent of the reading experts had published at least one article since obtaining the doctorate. Worthen and Roaden (1968) reported that forty percent of the AERA respondents had neither received a research grant nor published any research articles or reports since receiving their highest degree. An additional thirty-three percent had averaged less than one research product (grants or publications) per year. Twelve percent averaged two or more research products per year. Of Persell's (1971) group, 15 percent had published only one report, although thirty-two percent had published ten or more papers. (Again, the nature of Persell's group must be remembered, since they were chosen for productivity.) Relationships have been reported by Worthen and Roaden (1968) between research productivity and previous graduate experience as a research assistant, when research was the primary activity of the assistantship. This relationship will be considered in further depth in a later section of this chapter.[17]

Research Quality In her analysis of the quality of educational research, Persell (1971) concluded that a considerable proportion (43 percent) of the papers analyzed were rated below average or incompetent with respect to one or more of the three dimensions of quality.[18]

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[17] Sieber and Lazarsfeld (1966) have been cited as a source of information about productivity. The definition of productivity used by those authors, however, refers to the rate of production of researchers by an institution. Thus, those findings are not included in the present section.

[18] The reader is reminded that Persell's three dimensions of research quality included (a) contribution to theory, (b) contribution to practice, and (c) use of (or contribution to) research methods.

In examining those variables which related to the contribution of the research to theory, practice or research methods, Persell found that practice-oriented socialization (possession of an Ed.D., teaching experience, or professional education courses) was negatively related to those research contributions. Graduate experience in prestigious departments was positively related to quality, as were career research experience, research orientation, and intellectual orientation. The author found that productivity (number of products) was not related to contribution to educational practice or the use of research methods, but among behavioral scientists, was positively related to contribution to theory.

It would appear from empirical results that large proportions of educational researchers are neither heavily involved in nor highly productive of research. Of those who are involved, significant proportions of the work they produce do not appear to be making substantial contributions to knowledge in the field. It may well be that the nature of a profession, as opposed to a discipline, may dictate against research pursuits for many professional personnel.

Professional Identification. In their study of educational researchers, Bargar, et al. (1965) found a high degree of consistency between the fields of present professional identification and previous academic training. There was also a tendency for individuals primarily identified with psychology and social science fields to have a secondary identification in the field of education.

Bargar and his colleagues also concluded that most respondents did not identify themselves professionally in areas which are primarily research oriented. The first choice of respondents for their professional identification was education (51.5 percent), with psychology being the second choice (39.7 percent) and sociology the third choice (5 percent).[19] Among the subfields of professional identification, educational administration was first, followed in order by educational subject areas (combined) and educational research. It was found that fewer than 20 percent of their subjects were in areas which they considered "obviously research-oriented," such as educational research, educational psychology, and educational sociology.

Professional Association. Information is available on educational researchers' affiliation with the largest of the professional organizations devoted to educational research, namely the American Educational Research Association (AERA). Worthen and Roaden (1969) conducted an analysis of the proportion of AERA members among authors of journal articles in eight educational research journals during the 31 month period from January 1966 to July 1968. They found that only 28 percent of this group of persons who produced educational research during this period were affiliated with AERA.

Worthen and Roaden also examined the research involvement and productivity of persons who were members of AERA. They concluded that " he majority of AERA members who do research spend relatively little time on it in comparison with their other professional activities" (Worthen and

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[19] It is unclear whether Bargar, et al. considered the field of psychology as a whole to be research-oriented.

Roaden, 1969, p. 5), and research is their primary role less often than are other professional roles. Also, AERA members were not found to be heavily involved in research administration or in the teaching of research methodology courses, two roles which facilitate research. The authors concluded, however, that if a researcher were defined as anyone who either spends one day or more per week in research or spends one day or more per week administering research or teaching a research methods course (a liberal criterion), as many as 60 percent of AERA members would qualify as researchers. If productivity is examined, however, Worthen and Roaden concluded that a majority of members are not productive of research when one applies the criterion of one research product (article or report) per year.

The Researchers and the Settings for Research Activities: A Discussion[20]

In the preceding sections, a summary of relevant research results has been used to describe the characteristics of educational researchers. Those variables have been discussed which distinguish between members of the research community who make research contributions to the field and those who do not.

Empirical evidence has shown that contributing researchers are more likely than noncontributors to be young upon receipt of the doctorate, to have studied continuously for the degree, to have broader academic training and less educational practice, to have research experience in graduate school and to be involved at least to a small extent in research careers. Conversely, when one looks at the potential educational research community as a whole (all education doctorates plus persons in other fields who have an identification with or interest in education as a field of study), a majority of these persons are found to be older upon receipt of degree, to have studied part-time for the doctorate, to have been involved heavily as an educational practitioner prior to, during and/or after their doctoral study, to lack systematic experience-based training in research and to be engaged in professional positions where research is not an important or predominant activity.

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[20] Discussion in this section uses the research results reviewed previously as a springboard for speculation about probable relationships among the variables. Admittedly, this represents extrapolation beyond the data on the part of the present authors.

Several explanations might be given for this contrast between the characteristics of contributors and those of many persons who by virtue of their interest and affiliation with the discipline ought to form the contributing body of scholars. Three plausible explanations are provided below: (1) there is insufficient training in research and scarce numbers of role models for educationists who might become researchers; (2) there are insufficient rewards for educationists to learn about and engage in research activities as opposed to practitioner activities; and (3) the interests, needs and motives of persons engaged in educational practice are fundamentally different from those possessed by researchers. All three explanations are in fact variants of a single theme: whatever it takes to nurture, motivate, and support the researcher, both personally and institutionally, is largely missing from (or its impact moderated in) the development of persons in the field of education.

It is interesting to speculate about the development of both contributors and noncontributors to research in education. The career patterns studies by Worthen (1969) indicate that the majority of Bargar's self-nominated educational researchers have origins within the discipline of education. This would mean that as undergraduates these persons opted for professional training over liberal arts education. Personal orientation toward learning a specific "trade" or skill while in college might be an explanation of the personal security of a sure career at the end of study. Humanitarian and social service goals are not to be overlooked.

At the time he receives the bachelor's degree, the educationist is caught in the mainstream of teaching and educational practice in general. As a result he is absorbed in practical concerns and day-to-day problems which he must solve. Research is unavailable or unknown to him and thus not used as part of the problem-solving process. Therefore he relies on intuition and accumulating experience as sources of knowledge to use in solving his very important everyday problems. This orientation could be contrasted with one in which the most valued end of undergraduate training is in the intellectual activity of absorbing and contributing to a body of knowledge. The element of relative academic abilities must also be considered.

Given these sets of conditions, the educator emerges from a world of everyday educational problems to go to graduate school for quite different reasons than do scholars in nonapplied areas. Among likely reasons are the following:

1. Graduate study represents a way to advance in the profession through graduate credit hour increments.

2. Graduate work is a way to change roles within the system (again, personal motives). Here is where women may well fall out of the path to advancement--probably for reasons of gender role stereotypes which are incompatible with administrative posts or because of overt or covert role sanctions in the school setting.[21]
3. Graduate study provides specialized training, e.g., as school psychologist, counselor, or reading specialist, thus facilitating role changes as indicated above.
4. More specialized training might help attain personal social service goals related to finding more specific ways of serving the needs of children.

Contrast these motives with those of a potential researcher who approaches graduate school as a continuation of a process begun in undergraduate work--immersion in and contribution to a body of knowledge. Again the academic ability variable intrudes here. This contrast of motives, like most stereotypes, has its limitations. There is little in the research, however, to contradict it.

The orientation to training would also be different between the two groups. While a major part of the graduate training in most disciplines consists of equipping the student with the research tools needed to contribute to the field, the educationist (indeed the applied psychologist as well) aims primarily at acquiring specialized training that will allow him to assume a new role or advance within the institutional (i.e., clinic or school) setting. In this context, research methodology plays a secondary role for those individuals.

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[21] These comments are not intended to perpetuate gender role stereotypes. Rather they are part of an effort to understand the reasons for the sex composition of the research community as well as other professional groups.

Exposure to persons who are trained in research, who are engaged in research activities, or even who value inquiry might have an impact on the trainees. A small proportion of the faculties of schools of education, however, qualify as researchers (Puffer, 1967) and the university faculty members are primarily absorbed with the day-to-day problems of educational practices, albeit on different levels than the schoolmen they teach.

Furthermore, graduate study for educationists is generally a part-time, noncontinuous process which is interspersed between further career experiences (Buswell, et al., 1966). These experiences provide further interference between the practitioner and any successful inculcation of scholarly values by graduate training programs.

When graduate studies in education are viewed collectively, there emerge from this training process persons who are not adequately trained in research models or methods and who have values which supersede systematic inquiry. In their subsequent careers, there is probably little incentive for them to perform research, since the production of new knowledge, per se, is not as valued in most university education departments as many other activities. Instead, the predominant orientation in most education faculties is to develop solutions to problems on the basis of position statements or practical experience. In addition, the day-to-day problems of training teachers, administrators, counselors, etc., are pressing and important and tend to exclude consideration of research, simply because there is no time left in busy schedules to perform it.

This is not an indictment against educationists as opposed to academic researchers, nor is it a plea for recruitment solely among liberal arts graduates. Rather, it is a statement that those who are most likely to be committed to the field, and therefore form the most probable recruitment pools, are by personal inclination not research oriented; they are not oriented toward the use of research as a medium for increasing the body of knowledge in the discipline and by so doing solving its practical problems. This lack of orientation may be caused by personal inclinations toward social service goals and practical solution of ad hoc institutional problems away from the intellectual. The point is that the training processes fail to counterbalance these inclinations and provide an inquiry orientation.

Training Variables

This section of the paper deals with research which is focused specifically on the training of educational research and research-related personnel. The following areas will be considered: the goals of training programs, the structural arrangements of the programs, the substance and experiences of the programs, and the characteristics of recent trainees produced by the programs. Use of information from the previous sections on the variables which characterize existing researchers will be brought to bear on the training variables dealt with here to provide assistance in answering the general question, "How should training programs be conducted to go beyond simply perpetuating the existing personnel situation in the educational research community?"

Goals of the Training Program

No definitive list of goals or objectives of existing RDDE training programs could be found in the literature reviewed. Most of the training programs studied by Krathwohl (1965), however, had the training of research methodologists as their principal objective. Other studies (e.g., Fleury, 1968) indicated that the stated objectives for most Title IV training programs were much the same.

In a telephone survey of individuals who administer agencies in which research and research-related activities are conducted (Sanders and Worthen, 1970), an extensive collection of functions and competencies required of RDDE personnel as viewed by project administrators was identified.[22] It was concluded that the various skills required under the different functions (research, development, diffusion, and evaluation) are interrelated. Although these are identifiable functions, they share some common characteristics and should not be thought of as independent of one another. It was also concluded that (a) in each of several types of institutional setting (e.g., colleges and universities, school districts, state education departments) personnel may be engaged in several research-related functions and (b) all such functions are relevant to programs in any of the institutional settings surveyed. "In terms of relative importance, it appears that evaluation, development, and research rank in that order but all are high and close together on the scales used. Conversely, diffusion is viewed as relatively less important by the majority of inverviewees" (Sanders and Worthen, 1970, p. 35).

The question raised in the Sanders and Worthen study remains unanswered. If the functions are interrelated, ought the training programs to have as their objective the training of skills generalizable across the four functions? If the different functions call for different kinds of skills, however, the goals of the existing training programs may not be sufficiently responsive to the needs of the community. In studying the prospective roles for educational researchers, Fleury (1968) found that 94 percent of the ESEA Title IV programs prepared trainees to be researchers (23 percent of the programs prepared trainees for development roles and 6 percent for diffusion roles). He also found that employers of RDD personnel call upon them to perform each function periodically. Clark and Hopkins (1969) projected that, although demand for trainees in 1974 would outdistance the supply for research, development, and diffusion, the greatest percentage increase in demand would be for development roles followed closely by diffusion roles.[23]

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[22] The reader is directed to Technical Paper No. 27 or Technical Paper No. 3 for a listing of the competencies identified as important in performing each function and those identified as being in short supply.

It is also possible to interpret the Sanders and Worthen (1970) results and those of Fleury (1968) as indicative of a blurring of the distinctions among the inquiry-related functions. Further research on this topic has been conducted, which considers both the tasks performed and the competencies possessed by personnel who are performing work in inquiry-related positions.[24]

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[23] One must be ready to accept the assumptions made by Clark and Hopkins in order to accept these conclusions with confidence. The reader is referred to Technical Paper No. 27 for rationale for qualifying the conclusions reached in their study.

[24] The reader is directed to Chapter II above, which first appeared as Technical Paper No. 23 in the Task Force series. That paper was not completed at the time studies in the present chapter were reviewed and therefore is not included here.

Structural Arrangements of the Training Programs[25]

The question addressed in this section is the following: what institutional or structural characteristics of training programs have been associated with the production of significant numbers of researchers? The literature covers these topics: institutional selectivity,[26] the existence in the program of opportunities for interdisciplinary training or research apprenticeships, the existence of research bureaus within the institution, and the research climate of the institution.

Sieber and Lazarsfeld (1966) provide data on the ratio of doctorates who enter positions which emphasize research to the total number of doctorates produced by an institution. The authors find that high selectivity is a good predictor of high production of researchers. They conclude further that the greater the selectivity the greater is the output of researchers for that institution. Those schools which included professional experience and a teaching certificate as part of their entrance requirements tended to be those which had a relatively lower production of researchers.[27]

In an attempt to study the impact of other institutional arrangements on the production of researchers, Sieber and Lazarsfeld (1966) found that both the existence of a program designed specifically to train research methodologists and various measures of research climate were related to the production of researchers. Selectivity was a better predictor of productivity, however, even when the research climate was unfavorable. The interrelationship among these variables was emphasized by Millikan (1967) who concluded that the production of researchers by an institution was high when it possessed a "... cluster of organizational characteristics important for arrangements for research activity and training. Such characteristics include, among others, a closed level of admission to the graduate program, a high proportion of the graduate faculty doing research, graduate preparation for research emphasized, a high level of apprenticeship on projects, and a program for training in research" (Millikan, 1967, p. 13).[28]

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[25] These are institutional arrangements which must be distinguished from the effect of such arrangements on the individual trainee. The latter is covered in a later section.

[26] Selectivity here refers to the ratio of total number of applicants to the doctoral program to the number of applicants accepted in the program. It should not be confused with an absolute level of trainee quality that is acceptable for admission to a program, although the two may be related.

[27] It should be noted that the conclusions reached by Sieber and Lazarsfeld (1966) were based on descriptive statistics. The production of graduates entering primary research positions was compared by looking at the differences in percentage production between categories such as high and low selectivity. No inferential statistics were used, and causality can not be imputed to these results.

Sieber and Lazarsfeld (1966) also found that the following measures of research climate were related to the production of researchers: the quality of research performed by the institution (as judged by the respondents surveyed), the scope of research (number of topics under study), the research emphasis (high ranking, by deans, of research as a faculty responsibility), the existence of a research-oriented bureau, and an interdisciplinary relationship index (a large number of joint arrangements for research with departments outside of education).

According to another conclusion from Sieber and Lazarsfeld (1966), the existence of a research apprenticeship program is also associated with a high production of researchers, although courses in research methods are not. Again the interrelationship of several institutional variables is emphasized by Sieber and Lazarsfeld. They concluded that apprenticeship experiences were an important characteristic of training programs and were related to the presence or absence of an interdisciplinary faculty. "In the absence of an interdisciplinary faculty, apprenticeships are not positively related to the production of researchers and vice versa... Exposure to an interdisciplinary faculty is negatively related to the production of researchers when the level of apprenticeship is low" (Sieber and Lazarsfeld, 1966, pp. 307-308). Millikan (1967) found that the combination of an apprenticeship program with a high proportion of economic resources devoted to research was significant in an institution's production of researchers.

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[28] The Millikan (1967) study represented a re-analysis of the Sieber and Lazarsfeld (1966) data.

In considering the various relationships within bureaus and research institutes, Millikan cites both the volume of research activity conducted within the organization and the specific provision of research training for the students who work there as being important in the institutional production of researchers. In the same context, Sieber and Lazarsfeld (1966, p. 328) conclude that "Units which are affiliated with certain departments in the school of education are much more likely to provide opportunities for working on projects, and indeed tend to favor assistantships over dissertation work ..." They also found that facilitating units (facilitation refers to whether or not the unit facilitates the research of non-staff members or mainly operates its own program of research) less often provide opportunities to work with projects, tend to favor dissertation work over assistantships and more often have students from outside the school of education employed in the unit. It was concluded that these facilitating bureaus, regardless of departmental affiliation, were more productive of researchers than non-facilitating bureaus, "... when the school is judged as doing outstanding research, when more bureau personnel are involved in research than in field services, and when the bureau has relationships with departments and schools outside the school of education"[29] (Sieber and Lazarsfeld, 1966, p. 335).

One further set of findings having to do with the institutional characteristics of training programs has been reported. The small group of most productive scholars studied by Buswell, _et al_. (1966, p. 112) reported that they had attended institutions with the following: a strong research climate, graduate courses which emphasize (among other things) a minimum of course requirements and a maximum of independent study, a close relationship with outstanding, creative research professors, early immersion in active research projects, formal and informal contact with scholars from a variety of disciplines, propinquity of research staff and facilities, broad flexibility in program offerings, adequate physical facilities, libraries, and consulting help on research design. These outstanding researchers also reported, however, that insufficient economic resources devoted to research projects, little opportunity for coursework outside of their departments, insufficient financial support for graduate students, and insufficient training in research design were also characteristic of their programs.

The results which deal with the institutional arrangements for training programs seem to refer to commitment on the part of a graduate institution to give every opportunity for its trainees to learn research. This commitment is expressed by the monetary and personnel resources devoted to research activities and the provision of research bureaus, apprenticeship experiences, etc. When research involvement and a strong research climate are emphasized in these ways, the general value orientation may be transmitted to the trainees so that they will later opt for positions which involve research. The assumption is that the trainees, when trained under these arrangements, will be both trained for and oriented toward inquiry-related activities.

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[29] Again, the reader is alerted to the causality which the authors may be implying in this passage. Such an implication extends beyond the data presented.

Experiential Content of Training Programs

One area commonly considered to fall under the general heading of experiential research training is the dissertation. There is little information in the literature about the effect of the dissertation as a training vehicle. There are indications, however, that it does not provide the training in research that it might. It was surmised by Buswell, et al. (1966) from an anlysis of dissertations completed by education doctorates, that "There is a vast area of dissertation activity which may not merit the designation of research. The methods are fuzzy, the hypotheses non-existing or meaningless...and the statistics inappropriate. No clear models emerged in the analysis, which might be used to define and delineate the spectrums of appropriate dissertation designs. The 'product' or 'project' is clearly superseding the 'contribution to knowledge' objectives in many dissertation studies" (Buswell, et al., 1966, p. 70).

It may be true that a fair amount of "research training" occurs after a person receives the doctorate and is working on a job where research is required. This was sometimes true of the most productive group of researchers studied by Buswell, et al. (1966). Additional support for this contention comes from Persell's study (1971) which indicated that career research (i.e., post-doctoral) experience is more important than graduate research experience in its relationship to research quality.

One type of experiential content -- the research apprenticeship experience -- is discussed in a separate section below.

Research Apprenticeship

As noted in a previous section, the existence of a research apprenticeship program within a graduate institution (unlike the number or type of research courses offered) is related to the production of researchers by that institution. The effect of the research apprenticeship on the individual trainee will be considered in this section.[30]

The value of involving a graduate student in a research project as an apprentice has been discussed in various position statements and has been the focus of several research efforts. Buswell, et al. (1966) found that productive researchers had worked in a research bureau or institute as a research assistant significantly more often than had non-researchers. Those who turned out to be productive considered their assistantships to be more than just a means of financial aid. Further study by Clark (1957) indicated that significantly more of the "significant contributors" in psychology had held research assistantships than had psychologists in general.
Similar differences were also found between the two groups with respect to the holding of other kinds of graduate assistantships, suggesting that selectivity may explain the relationship between assistantship experiences

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[30] Some of the material in this section has been taken from an existing synthesis of research on research apprenticeships [Worthen, B. R. A review and synthesis of research on research assistantships. Boulder, Colorado: Laboratory of Educational Research, University of Colorado, 1971. (mimeo)]

and later productivity. Students of relatively greater ability more often might have been awarded the assistantships or might have gone on to be productive regardless of the apprenticeship training. A counter example to this explanation was given by Millikan (1967) who re-analyzed the Buswell, et al. (1966) data by dividing the respondent group into three categories: those who had held assistantships or fellowships with a research component; those who had held assistantships or fellowships without a research component; and those who had held neither an assistantship nor fellowship. The research group differed from the others by higher ratings on four criteria: publication of a research study which related to their dissertation topic; participation in research projects; percentage of time spent in research; and preference for research activities. These studies pointed to the value of the research assistantship as a training vehicle.

In a re-analysis of the Bargar (1965) data, Worthen (1969) found in his sample an over-all inverse relationship between research assistantship experience and later research involvement. The author presented several alternative hypotheses which might explain the discrepant results and tested these in a subsequent study (Worthen and Roaden, 1968). In that study, two general kinds of graduate research assistantships were differentiated. It was found that experience as a "genuine research assistant"[31] was related to subsequent research productivity and research involvement. Experience in "ersatz research assistantships"[32] was found to be unrelated to subsequent research productivity or involvement. Those persons who had held an ersatz research assistantship were found to be no more involved in or productive of research than those who had never held any kind of assistantship.

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[31] A "genuine research assistant" was one who served as an apprentice to a researcher, worked in a research bureau, or engaged in an internship capacity where research was the primary activity.

[32] This was a research assistantship which did not involve research as a primary activity.

A basic conclusion of the study was that "Research assistantship experience is a potentially valuable vehicle for training educational researchers who will continue in research. Whether or not a person actually engages in research as a major activity during his assistantship is a critical factor in determining whether the assistantship experience will be positively related or unrelated to subsequent research involvement" (Worthen and Roaden, 1968, p. 186).

The significance of this study was to point out that undifferentiated, unqualified research assistantships are not in themselves enough to insure career productivity. Other studies place further qualifications on the assistantship experience.

In still a later study, Worthen and Roaden (1971) studied the specific training experiences of those who had held genuine and ersatz research assistantships and found that even among the genuine assistants there were large differences in the subsequent research productivity and involvement of the subjects. Among those who had held a genuine assistantship, the productive persons significantly more often than the non-productive group had more experience in the conceptual steps of the research process, in the use of the computer for data analysis and in the use of statistical techniques. The unproductive group, on the other hand, was composed of persons who were more likely to have engaged in clerical activities and to have held the assistantship on one specific project outside of a research bureau or laboratory. Based on the differences found among the productive and non-productive holders of genuine assistantships, the authors made the following recommendations to research trainers: (1) involve the assistant in the full range of research tasks, (2) help him learn to apply correctly many statistical techniques, (3) teach him to use the computer, (4) see that the environment is conducive to research, (5) teach him research techniques, (6) make sure the research to which the assistant is assigned is of high quality, (7) provide adequate supervision and orientation, and (8) manifest faith in the assistant's competence.[33]

Further qualifications on the assumption that the apprenticeship experience in and of itself is related to productivity are shown in other studies. In an earlier section, the Sieber and Lazarsfeld (1966) study was discussed with respect to the existence within training programs of apprenticeship experiences. The authors of that study concluded that "... apprenticeship alone does not automatically guarantee that students are sufficiently prepared or motivated to pursue research careers. Both talent and institutional nurturance are necessary to reap the benefits of apprenticeship" (Sieber and Lazarsfeld, 1966, pp. 302-303). Still another qualification was identified by Persell (1971) who found that graduate research experience was related to research quality, but only if that experience took place in prestigious departments.

The results of the latter studies point out the danger of assuming that research apprenticeships are inherently valuable. "A more tenable assumption is that research apprenticeship experience is not inherently valuable -- rather, what a person does on his apprenticeship is more directly related to what he does later in his career than is the mere holding of the position" (Worthen, 1971, p. 46).

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[33] The authors did not always take note of or adequately explain the interactions found in the data. These interactions limit generalizability and impose a qualification on these conclusions.

Substantive Content of the Training Programs

Information on the content of existing college and university based training programs is both out of date and limited in terms of providing information on those features of the programs which are most valuable. One study (Krathwohl, 1965), although dated, provides information on the content of the research training programs in the 104 institutions offering the Ph.D. or Ed.D. in 1960. Among Krathwohl's specific findings are the following: 91 percent of the institutions had an introductory course in research methods, but only 13 percent had two or more research methods courses; 46 percent had an experimental design course; 96 percent had a statistics course (the mean number of statistics courses offered was 2.2). There was an average of three measurement courses available, although only a third of the institutions required one of these courses for graduate degrees. Research experience beyond the thesis as a formal requirement appeared to be rare. Thirty-eight institutions had programs (either operational or submitted for institutional approval) to train research methodologists. Most of the programs for methodologists required "... some kind of an academic home besides methodology, the most frequent one being educational psychology. Quite a few encourage work in the basic social sciences as well..." (Krathwohl, 1965, p. 83).

Title IV Programs in Research Training

The findings of the Krathwohl study are a representation of research training programs before the impact of Title IV of the ESEA of 1965 was felt.

One section of this title authorized substantial financial support of training for excellence in educational research through the "... development and strengthening of research training staffs; to expand the capacity and curricular capability for training; to help in the development of specialized training programs, and through trainee stipend awards, to enable a greater number of persons to pursue careers in educational research" (U.S.O.E., 1965, p. 3). Since its inception, the Title IV-sponsored programs represented the only major concentrated effort in this area. These programs became the primary vehicle for educational research training. The literature offers descriptive information on the training programs and the trainees graduating from them. At a later point, by relating the findings already discussed in this chapter on the characteristics of the trainees and the programs, some hypotheses are raised concerning the potential impact of the Title IV program on educational researchers.

Characteristics of the Title IV trainees have been investigated in two studies. Sieber (1968) and Hopkins, et al. (1970) studied the 1966-67 and 1969-70 trainee groups respectively. They observed that Title IV trainees received their doctorates at approximately age 31, seven years younger than the 1964 group Buswell, et al. (1966) studied. Considering the fact that the average age at the receipt of the doctorate had been stable in the decade prior to 1964, it appears that Title IV programs have significantly altered this characteristic.

Considering further the relationship found between early entry into the field and productivity of research (Buswell, et al., 1966) and between relative youth of the researcher and his research product quality (Persell, 1971), it appears that the programs potentially have made an impact in an area which will pay dividends to the field. Hopkins, et al. (1970) concluded that the emphasis upon younger trainees produced an increase in the proportion of students recruited directly from their previous degree program. The proportion of trainees who entered the doctoral program immediately after completing the bachelor's degree changed from 37 percent for the 1966-67 group to 54 percent for the 1969-70 group.

For those trainees who were employed between receiving the bachelor's degree and entering the graduate program, Sieber (1968) found that 66 percent had worked in an educational setting which involved no research activities. Two-thirds of the sample had a previous degree in some area of professional education. In addition, Sieber found that trainees were more often committed to professional education than were researchers at large. These findings led the author to conclude that the trainees, as constituted at the time, would tend to increase the concentration of professional education background and orientation among educational researchers. Sieber compared this conclusion with that of Buswell, et al. (1966) that the most productive researchers in the field came more often from outside professional education. The further conclusion from Buswell and his colleagues that teaching experience is negatively related to productivity and the conclusion from Persell (1971) that practice-oriented socialization (graduate training or experience which is related more to educational practice than research) is negatively related to research product quality, are also relevant.

Hopkins, et al. (1970) stated that far fewer of the 1969-70 trainees had work experience of any kind prior to program entry than did the Sieber group. The 1969-70 trainees who had not come directly from an undergraduate degree were more likely to have been recruited from positions which involved some research activity. The 1969-70 group also was found to have a somewhat broader disciplinary base than did education students in earlier years, especially in academic work in the behavioral and social sciences. Three-fourths of the 1969-70 group of trainees had an undergraduate major outside education. One fourth of the trainees were studying for doctorates outside education. There was also a greater tendency on the part of the 1969-70 trainees to seek the Ph.D. rather than the Ed.D. (69 percent compared to 54 percent of the 1966-67 group and 33 percent of the Buswell, et al., 1966 sample).

Hopkins, et al. (1970) found that the 1969-70 group of trainees was quite talented academically. Their Graduate Record Exam and Miller Analogies Test scores were on a par with or higher than the scores of the majority of students in nearly every professional and substantive field for which scores are available.

The Title IV trainee stipends allow the graduates to pursue their training full-time and continuously, a factor which Buswell, et al. (1966) found related to subsequent productivity.

Concerning the characteristics of the trainee programs themselves, Sieber (1968) concluded that the training programs were located in the universities which promised the best contribution to research training. Hopkins, Worthen and Soptick (1970) agreed. They concluded that, for the most part, the training programs were located at good training institutions, approximately two-thirds of the programs being at institutions cited for the quality of their research. Of the remaining institutions not cited for research quality per se, many were nevertheless noted for overall institutional quality.

This information relates to the prior conclusion of Sieber and Lazarsfeld (1966) regarding the relationship of research climate (specifically the quality of research done at an institution) to an institution's production of researchers.

Selectivity also was found to relate to the production of researchers by an institution (Sieber and Lazarsfeld, 1966). Information from the literature is limited with respect to the selectivity of the Title IV training programs, although Sieber (1968) reports that the two most often used criteria for admission to the programs were interest in research and interest in the training program. Sieber (1968) found that about half of the programs used the GRE scores for screening applicants. The MAT was used by about one third of the programs. Fleury (1968) reported that 76 percent of the programs required the GRE but only 39 percent of these had a specific score required for admission. Forty-four percent required the MAT and of these, only 17 percent apparently used it actually to determine admission into the program. Fleury (1968) also reported that 48 percent of the programs designated a specific minimum undergraduate grade point average (34 percent specified a 3.00 or "B" average).

Concerning professional experience, Fleury (1968) found that 45 percent of the programs required or preferred professional or school-related experience or teaching or administrative experience, while 55 percent did not mention or require such professional experience. Sieber and Lazarsfeld (1966) had previously been cited as the source of the following statements: ". . . the production of researchers (by an institution) is negatively related to the requirements of professional experience" (Sieber and Lazarsfeld, 1966, p. 276).

Sieber (1968) found that only a minority of the Title IV programs required interdisciplinary training. Approximately 75 percent of the programs were located in schools of education. The substantive fields in which research training was being provided tended to be fields of professional education. In only about one half of the cases where it was possible to do so were students actually participating in the work of educational research organizations on their campuses. Directors of Title IV programs predominantly were located in teaching departments rather than research units and were found more often in fields of professional education than were researchers at large. These findings relate to the conclusion (Sieber, 1968) that the training programs were not utilizing the full range of training talent available in the university setting (i.e., using noneducation personnel and resources). It should be remembered that Sieber and Lazarsfeld (1966) found a relationship between interdisciplinary training in an institution and the proportion of that institution's graduates who enter research positions. This relationship also depended on the provision of apprenticeship in the training programs. Sieber (1968) found that 89 percent of the programs required research work of their trainees. Fleury (1968) found that 92 percent of the programs required practicum or apprenticeship with 600 hours as the time allotment suggested by USOE. Since the nature of this research work was not explored, its relationship to the research apprenticeship variables examined in an earlier section cannot be told.

In terms of age, 18 percent of the training programs specified "young" candidates (25-49 years old) while 82 percent did not mention age as a requirement.

The content and substance of the Title IV training programs have remained the areas of greatest ignorance (Hopkins, et al., 1970). The evaluation reports submitted annually to the Research Training Branch of the U.S. Office of Education should, but do not, provide information beyond course titles in this area. Fleury (1968) in his study of Title IV programs found that "The mean graduate level research training program requires two courses in statistics (up through analysis of variance and covariance), one course in research methods, one course in experimental design, one course in tests and measurement, and one course in data processing" (Fleury, 1968, p. 140). Forty-nine percent of the training programs required a major in a cognate discipline and 22 percent required a minor or research preparation in a cognate discipline. It should be remembered, however, that Sieber and Lazarsfeld (1966) found that the specific research courses required in a program in the past were unrelated to the institutional output of researchers.

It appears that Title IV programs and trainee characteristics appear to approximate the arrangements which characterize productive programs and productive researchers. The trainees are younger, have greater academic ability, broader academic training both before and during their graduate programs and have less of the interference of educational practice. Their programs are characterized by full-time continuous study (by virtue of trainee stipends) and systematic internship experience in research. The substantive content of the training programs and the academic preparation of the program trainers also may make an impact by providing effective role models for the trainees.

Training Variables: A Discussion

The results of research dealing with training program characteristics, institutional arrangements for training programs, and the Title IV graduate trainees and programs have been discussed in this section. One might speculate upon the past and present impact of Title IV on research training, and on the potential future impact on research training of the demise of this program. For by one reason or another, Title IV programs succeeded in attracting to the field of educational inquiry persons of higher academic ability than the bulk of those who form the present pool of potential educational researchers, persons who are younger and have broader academic backgrounds and less practitioner experience--in short, persons who have the characteristics which prior research indicates contribute to increased knowledge in the field. By inference, these are the persons who are oriented more toward contributing knowledge to an academic field than to engaging in educational research.

That educational research should attract such persons must be a function of the rewards offered by the programs--either money or training opportunities of quality which fit with their scholarly interests. An assumption which might be made is that when the rewards for entering the program are substantial, they will attract a greater number of interested persons, and the most qualified will be accepted. But the program's success cannot be predicted solely on these characteristics; research is needed which will follow up on the groups studied by Sieber (1966) and Hopkins, et al. (1970) to check on their productivity.

Although data do not exist to support the statement that educational research training programs sponsored by Title IV are substantively better (i.e., that their content and experiences are superior to non-Title IV or pre-Title IV research training programs) improved substance and content were among the goals of the Office of Education in designing the Title IV program.

As Federally-funded training programs are reduced or phased out of existence, the question becomes whether the non-monetary rewards of the quality programs will provide enough motivation to attract high ability, research-oriented trainees. It is conceivable that the substance of the programs, upgraded as the result of Title IV monies, might continue in its present form after the funding is discontinued. In the case of this eventuality, the level of trainee quality might not be adversely affected. If, however, the monetary incentive to trainees is the crucial factor, then the trainee community will revert to type after the funds are exhausted.

If it is found that the funding is a crucial factor in attracting persons already oriented to research, and this funding is not available, then it may be necessary to find ways in which persons who are already involved in educational pursuits can become oriented to and then effectively trained in research through existing institutional arrangements.

Summary

This review of information on the training of educational researchers is limited to the results of research which have passed tests of methodological adequacy. Included are studies on the characteristics of educational researchers and their professional work and studies involving training variables, such as the selection of trainees and trainee characteristics, the goals and nature of training programs, and the institutional setting for the training of researchers. It is clear from the studies identified that there is an abundance of information on some of the topics listed above and a major deficit in others. Information is available on which to base descriptions of the individuals who are educational researchers. Information is also available to describe the institutional settings in which the majority of the training effort is concentrated. Finally, information is available with which to describe the general nature of the research process. Major deficits exist in the areas of manpower needs, the specific nature of training, and the nature of training needs in the research-related roles of development, diffusion and evaluation.

Studies are needed which answer the following questions before long-range planning can be effected for a system for educating the research and research-related personnel needed in education.

1. What are the continuing manpower needs in the following roles in education:
    a. Production of broadly generalizeable knowledge about the process of education;

b. The creation of the products and procedures needed for the conduct of education;

c. The distribution of information among the various specialties in the education system; and,

d. The generation of evaluative information about educational products, programs, and processes.

2. What are the specific concepts and skills that are needed to perform in each of these roles? (The answer to this question must go beyond the boundaries of empirical technique; the method of research encompasses more than sampling, measuring, and analyzing data. The same is true for the other three roles.)
3. What procedures are effective in assisting students to the mastery of the concepts and skills referred to in question two?

The answers to these questions should not be considered as static items, once determined, to be true for all time. A vehicle is needed to obtain the information initially and to continually update and refine that store of information. Without a continuing vehicle, the effort to answer the questions suffers from a time constraint which will make the information produced of questionable value within a decade.

The process of preparing educational research and research-related personnel is a complex effort which defies summary in a short summary section. To attempt to do so would do injustice to the topic. What is known with some degree of surety is presented in the preceding pages. What is not known is suggested in the questions above.

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APPENDIX A

INTERVIEW RECORD FORM

APPENDIX A

INTERVIEW RECORD FORM

Name of Interviewee ______________________________

Job Title ______________________________

Employer ______________________________

Location ______________________________

Date of Interview ______________________________

Time: Start ____________________

Finish ____________________

Interviewer ______________________________

MAJOR AREAS OF ACTIVITY

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

APPENDIX B

INTERVIEW DATA SHEET

APPENDIX B

INTERVIEW DATA SHEET Page ____

Interviewee ______________________________

Check ONE:

☐ Activities During Past 2 Weeks: Day ____________

☐ Major Area of Activity ______________________

TASK	COMPETENCY
	1.
	2.
	3.
	4.
	5.
	6.
	1.
	2.
	3.
	4.
	5.
	6.
	1.
	2.
	3.
	4.
	5.
	6.

APPENDIX C

LIST OF 69 TASKS

Task Number	Task Categories
T 1	Reading the literature and acquiring up-to-date information through other means. This task includes general reading and informal contacts (e.g., discussions or correspondence with colleagues) which result in increased knowledge about RDDE or another substantive area.
T 2	Utilizing formal search procedures to acquire information. This includes identification of information sources (both human and material), acquiring information through retrieval systems such as ERIC, and the preparation of bibliographies and abstracts based upon the information acquired through these procedures. The distinction between this task and the previous one is that the previous one is general "keeping up with the field" while this task is the systematic acquisition of information on a particular topic for a specific purpose.
T 3	Conceptualizing or formulating a problem or hypothesis for empirical studies. This task includes identifying and delineating a problem for study and determining what specific questions will be investigated in the study.
T 4	Conducting philosophical and historical analyses. Included are such activities as formulating logical arguments, conducting content or semantic analyses, historiography, etc. Because both philosophical and historical analysis tended to occur together in the present sample, they are included together here as one task.
T 5	Identifying a product or program which needs to be developed. This development task includes assessment of needs and is analogous to the research task described in Number 3 above.
T 6	Formulating a design for a research study. This task includes not only the choosing of a specific experimental design such as a Solomon IV group design or time series analysis, but the overall research design for any type of research study (e.g., ex post facto design).
T 7	Formulating a design or plan for an evaluation. This covers all types of evaluations and is the evaluation analog to research Task 6 above.
T 8	Designing a specific educational development activity. This task is generally sequential to Task 5, i.e., follows the identifying of a needed product or program. It includes the overall planning of the development project and identification of various activities which will be required to develop the product or program.

Task Number	Task Categories
T 9	Conducting, managing, or monitoring a formative evaluation. Once a formative evaluation is designed, this task includes all aspects of conducting the evaluation, with the exception of those specific evaluation tasks which are identified under other task numbers.
T10	Conducting, managing, or monitoring a summative evaluation. This task is the summative evaluation analog to Task 9 above.
T11	Writing a proposal. This task includes (a) proposals which are written for the purpose of seeking funds and (b) proposals which are written for submission to persons who must give their approval before a particular RDDE activity can be conducted.
T12	Formulating budgets and conducting cost-analyses.
T13	Utilizing a PERT or other management planning system. This task includes both developing the system (e.g., constructing a PERT network) and utilizing the system (e.g., using a PERT network in monitoring an activity).
T14	Engaging in executive planning and policy making. This task includes making major program decisions (e.g., what should be the overall program emphasis of an R and D center) and making personnel policy decisions (e.g., should RAs be expected to work between semesters).
T15	Allocating human and material resources to activities. This task includes (a) day-to-day decisions about allocating staff to activities (e.g., deciding how many staff members will work on a specific activity) and (b) allocating and managing other resources (e.g., deciding whether or not project monies should be used to purchase a particular piece of equipment).
T16	Communicating and negotiating with funding agencies. This task includes all contacts with a funding agency, both before funds are obtained and during the time in which funds are being spent.
T17	Preparing RFPs and guidelines for preparation of proposals. This task is conducted primarily within funding agencies which support RDDE activities; however, persons in a variety of agencies are asked to assist in preparing such RFP's and guidelines.
T18	Reviewing and evaluating proposals submitted for funding.

Task Number	Task Categories
T19	Processing proposals for funding and monitoring funded proposals. This task includes activities which occur subsequent to a decision to fund a given activity. It includes dispensing funds as well as monitoring the activities for which the monies were awarded.
T20	Orienting, training, and upgrading project personnel. This task includes all training of project personnel (in contrast to Task 63) and includes both new and veteran personnel.
T21	Supervising professional personnel. This task differs from Task 15 in that it does not include decisions about what staff resources will be utilized for a given task but instead covers the supervision, monitoring, and assisting of personnel who work on a specific activity.
T22	Supervising support personnel. This task is analogous to Task 21, but includes personnel such as programmers, technicians, and A-V personnel.
T23	Hiring and recruiting personnel. This task includes recruiting paid employees of an agency but does not include activities such as obtaining subjects for a study or participants in an in-service education program.
T24	Designing and selecting facilities and capital equipment. Both buildings and equipment are included here.
T25	Identifying and formulating educational objectives. This task includes identifying general goals and objectives as well as stating objectives in behavioral form.
T26	Specifying and sequencing learning activities. This task includes specifying and sequencing learning activities to achieve specified instructional objectives.
T27	Making projections, forecasting, and analyzing trends. This task includes both use of logical analysis as well as formal statistical techniques for projecting, forecasting, and analyzing trends.
T28	Designing curriculum materials. This task includes designing materials to (a) include learning activities specified in Task 26 and (b) attain objectives stated in Task 25.
T29	Writing or revising printed curriculum materials. This task includes both the initial writing done in the development of educational materials and subsequent modification of existing materials. It does not include the writing of reports about such educational materials or their development (writing of such reports is included in Task 53).

Task Number	Task Categories
T30	Developing non-textual learning materials. Examples of such materials are audio tapes, films, and manipulative materials. This task is analogous to 29 above but is focused upon learning materials other than those in written form.
T31	Producing or supervising the production of curriculum materials in quantity. This task includes the mass production of materials which have already been developed.
T32	Repairing and maintaining equipment (other than computers). This task includes the actual repair and maintenance of equipment and does not include the supervision of personnel doing such work. (Such supervision is included in Task 22.)
T33	Planning data collection procedures. Planning how to collect data (as opposed to actual collection of data) is included in this task.
T34	Selecting or constructing and revising ability and/or achievement tests. Selecting an available standardized instrument is included here along with constructing tests and revising them through item analysis and other techniques.
T35	Selecting or constructing and revising measures of affect. This task is analogous to Task 34 above.
T36	Selecting or constructing and revising questionnaires, checklists, interview schedules, and observation systems.
T37	Scaling, norming and establishing reliability and validity of measuring instruments.
T38	Conducting interviews. This task applies only to the actual conducting of interviews and does not include construction of the interview schedule, which would be included in Task 36 above.
T39	Administering group tests and collecting data by use of paper and pencil instruments. This task includes distributing instruments to an intact group, such as a class, as well as distributing questionnaires by mail, etc.
T40	Administering individual tests. This task includes activities such as administering the Stanford-Binet Intelligence Scale and other psychological instruments which are administered on an individual basis.

Task Number	Task Categories
T41	Using formal or informal observation systems to code human behavior. An example of this task would be the use of Flanders' Interaction Analysis System to code the activities in a classroom; the task does not include the actual construction of an observation system, which would be included in Task 36 above.
T42	Tabulating and categorizing data. This task includes the formulation of the categories into which the data will be tabulated, as well as the actual tabulation.
T43	Reviewing and critiquing extant educational programs and products. This task includes making judgments about books, hardware, curriculum materials, etc., but does not include judging the results of research or research-related activities, which are included in Task 56.
T44	Field testing of curriculum materials. This task, which is restricted to that field testing which is specifically a part of a development project, includes planning, selecting sites or subjects, and conducting field tests.
T45	Scoring tests. This task includes simple "clerical" scoring as well as that which requires professional judgment. It includes both hand scoring and any scoring work that might need to be done preparatory to submitting answer sheets to computer personnel for coding and computer scoring. Actual use of the computer for scoring is included in Task 49 below.
T46	Planning and/or selecting data analysis techniques. This task includes only the planning or selecting of the data analysis techniques; actually conducting the analysis is included in other tasks below.
T47	Conducting data analyses by non-computerized methods. This task includes compiling data (other than that formal categorization work included in Task 42 above) and doing computational work by hand or on a desk calculator.
T48	Developing a computerized data bank and retrieval system.
T49	Using computer facilities and services. This task includes selecting existing programs, coding, designing formats, and preparing data for analysis by existing programs. This category includes computer scoring of tests.

Task Number	Task Categories
T50	Designing computer systems, inspecting and diagnosing computer problems and repairing computer equipment. Note the distinction between designing computer systems in this task and designing computer programs, which is included in Task 52 below. This task emphasizes primarily work with computer hardware.
T51	Interpreting, reviewing, and integrating the results of data analysis. Note that this task applies only to the interpretation of the results of data analysis and does not apply to the data analysis itself.
T52	Designing computer programs and programming. This task includes only software computer design work.
T53	Writing research and research-related reports, books and articles. Rewriting and revising is also included in this task.
T54	Preparing and delivering a lecture or oral presentation on a research or research-related topic. This task is analogous to Task 53, but is focused upon oral, rather than written communication.
T55	Conducting conferences for dissemination purposes. This includes all dissemination conferences except those in-service education programs which are included in Task 63 below.
T56	Reviewing and evaluating research and research-related reports. This task is analogous to Task 43 above, except the focus here is on judging reports of research and research-related activities rather than educational programs or products.
T57	Preparing reports, educational materials, and other printed materials for mass production. This task covers layout, proofing, organizing, copy editing, etc. It is distinct from Task 31, which deals with the production of materials after they have been prepared for mass reproduction.
T58	Disseminating information about activities on a specific project or in a specific agency. This task includes such diverse activities as writing letters to disseminate information, handling phone calls in which information is sought, and arranging for interested persons to visit school tryout centers.
T59	Selecting, securing, and using consultants. This task includes only the process of obtaining assistance from consultants; it does not include an interviewee's work as a consultant. Work that an interviewee performs as a consultant would go in the appropriate task category which describes the specific task in which he was engaged while serving as a consultant.

Task Number	Task Categories
T60	Negotiating with publishers and equipment manufacturers.
T61	Planning dissemination activities. This task is analogous to Tasks 6, 7 and 8 for research, evaluation, and development.
T62	Conducting on-site evaluation visits. This task includes site visits to evaluate institutions or educational programs or products being used at the site.
T63	Conducting in-service education programs. This task includes planning, managing, and conducting an in-service education program, as well as actual teaching within that program.
T64	Translating written materials from one language to another.
T65	Developing and modifying information storage and retrieval systems. This task includes such activities as the development of an ERIC clearinghouse system.
T66	Selecting and indexing documents for inclusion in information storage and retrieval systems.
T67	Writing abstracts of materials selected for inclusion in an information storage and retrieval system. This task includes the preparation of abstracts for input into a system. It does not include writing abstracts for one's own use, even though the information being abstracted is taken from an information retrieval system; this latter activity is included in Task 2 above.
T68	Conducting a research study. This task covers all activities involved in conducting a research study, with the exception of activities specifically listed under other tasks. Examples would include obtaining subjects for a study, administering the treatment, etc.
T69	Conducting dissemination activities. This task includes miscellaneous dissemination tasks such as ordering equipment for a demonstration school, soliciting cooperation from a school to serve as a demonstration center, or distributing printed dissemination materials through various means. It specifically excludes the following dissemination activities: (a) preparing written materials of the type included in Task 53 above, (b) conducting conferences as specified in Task 55 above, (c) disseminating information about project activities as specified in Task 58 above, or (d) conducting in-service education programs as specified in Task 63 above.

APPENDIX D

LIST OF 226 COMPETENCIES

Competency Number*	Competency Categories
C101	Knowledge of inquiry techniques in other disciplines. This refers to a general knowledge of inquiry techniques in several disciplines.
C102	Ability to discuss the advantages of establishing evaluation systems in educational institutions. This category also includes the ability to discuss any aspects of evaluation (e.g., diminishing the threat of evaluation) with such persons as school administrators or teachers.
C103	Ability to engage in effective oral communication with others.
C104	Ability to listen effectively. This competency simply refers to the ability to be a good listener and be sensitive to what is being said in a discussion.
C105	Knowledge of personnel and the organizational structures of public school systems and universities. This knowledge entails a general understanding of personnel and operations in the field of education at all levels.
C106	Ability to work with public school, university, or state department of education personnel. An example of this competency might be in persuading teachers or administrators in a public school system to allow a research project to be conducted in that school system.
C107	Ability to determine the evaluative questions which must be asked in evaluations and the information which must be gathered to answer these questions.

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*The numbering of competencies is an outgrowth of the initial listing of competencies in categories. Twelve "look-alike" categories were established and each was assigned a range of digits (e.g., 001-099 for category 1, 361-368 for category 5, 801-836 for category 12). Entries in each category were numbered sequentially within categories as they were added, resulting in a final numbering system which has gaps from the final entry in one category to the first entry in the next (e.g., 376, 377, 378, 401, 402). In retrospect, some early entries might have been better placed in another catetory; however, since the numerals were only for purposes of identification and clustering of factors was entrusted to the factor analysis, there seemed little profit in moving competencies to fit a priori logical analysis, prior to empirical analysis.

Competency Number	Competency Categories
C108	Ability to obtain and use feedback for management purposes in an on-going program or project.
C109	Ability to help others identify and state their objectives. This skill relates to the important evaluation function of helping persons responsible for educational activities or institutions identify and articulate the objectives of the activity or institution. This skill must be applied as an initial step in constructing an evaluation plan.
C110	Knowledge of various evaluation models (e.g., the CIPP Model or Stake's model).
C111	Ability to be objective. This is the ability to avoid injecting one's own values or biases into an inquiry activity.
C112	Ability to design or conduct interviews for the purpose of collecting data. This competency is in contrast with Competency 617 which includes job interviews, which have as their primary purpose the hiring of personnel.
C113	Ability to involve the community in evaluation projects or developing educational programs. This competency refers to the ability to use community input in establishing priorities, assessing how widely program objectives are shared by the community, etc.
C114	Ability to translate data analyses into recommendations for action.
C115	Ability to incorporate systematic evaluation procedures into plans for developing educational programs.
C116	Ability to develop techniques for providing evaluative feedback to program or project personnel in time to allow needed modifications to be made during the operation of the program.
C117	Ability to identify the decision makers who need evaluative feedback.
C118	Ability to secure cooperation from persons necessary to conduct an inquiry or inquiry-related activity. An example of this competency would be getting school administrators to participate as subjects in a study of administrative styles.
C119	Knowledge of factors which increase or decrease credibility of evaluation reports.
C201	Knowledge of and ability to plan data collection procedures appropriate to a specific inquiry activity.

Competency Number	Competency Categories
C202	Knowledge of measurement theory and techniques.
C203	Knowledge of criterion-referenced testing.
C204	Knowledge of general principles of instrument construction.
C205	Knowledge of questionnaire construction techniques and appropriate uses for questionnaires.
C206	Ability to construct instruments to assess attitudes and other affective variables. The ability to use personality tests is included in this competency.
C207	Ability to select appropriate standardized tests or instruments. This ability would require knowledge of principles of instrument construction but would go beyond that to also require knowledge of sources of reliable information about standardized instruments.
C208	Knowledge of norming procedures.
C209	Knowledge of theory and techniques for assessing student achievement.
C210	Knowledge of systems developed to categorize human behavior or abilities. Examples of such systems would be (a) a method of task analysis such as Gagné's "backward chaining," or (b) Bloom's taxonomy in the cognitive domain.
C211	Ability to construct items that measure what one sets out to measure. An alternate way of describing this competency is "the ability to achieve construct validity" for a given instrument.
C212	Ability to write unambiguous items in vocabulary appropriate to the specified audience. This competency requires a knowledge of the vocabulary level of the prospective respondents to an instrument.
C213	Ability to construct items in such a way that they increase the likelihood of response. Included in this competency would be the ability to construct items which (a) are not inflammatory in nature, (b) are not overly threatening, and (c) motivate the respondent to complete them.
C214	Ability to determine a logical sequence for all items in an instrument.
C215	Ability to construct good multiple choice or other types of objective items.
C216	Ability to construct good open-ended or essay items.

Competency Number	Competency Categories
C217	Ability to arrange a response format for items which will facilitate later coding and analysis of the data.
C218	Ability to conduct item analyses, including computing difficulty and discrimination indices.
C219	Ability to design a clear instruction manual for the administration of tests.
C220	Knowledge of and ability to use unobtrusive measurement techniques.
C221	Ability to construct good rating scales.
C222	Ability to construct culture-free measures.
C223	Ability to arrange items in a format which is easy to read. This competency includes determining the proper number of items per page, good printed or typed formats, etc.
C301	Knowledge of different types of research methods. This is a very broad competency relating to an understanding of different types of research methodology, such as empirical research, historiography, etc.
C302	Knowledge of survey research designs and techniques.
C303	Knowledge of general principles of research design.
C304	Knowledge of specific experimental and quasi-experimental research designs. Knowledge of the Campbell-Stanley designs would be included here.*
C305	Knowledge of factors which jeopardize internal and external validity. Again, knowledge of Campbell and Stanley's list of threats to validity would be included here.

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*Campbell, D. T., & Stanley, J. C. Experimental and quasi-experimental designs for research on teaching. In N. L. Gage (Ed.), Handbook of research on teaching. Chicago: Rand McNally, 1963. (Reprinted as Experimental and quasi-experimental designs for research. Chicago: Rand McNally, 1966.)

Competency Number	Competency Categories
C306	Ability to operationalize a research or evaluation design into specific procedures for conducting the study.
C307	Ability to design studies to control extraneous variables. Included in this competency would be knowledge of appropriate uses of a control group and other means for exercising control in a study to arrive at unequivocal conclusions.
C308	Ability to identify variables which should be included in a research or evaluation study.
C309	Knowledge of sampling theory and techniques.
C310	Knowledge of methods for planning or installing a complete curriculum or a curriculum package.
C311	Knowledge of case study designs.
C312	Ability to plan effective development procedures.
C313	Ability to identify the problem and articulate the problem statement in a research or evaluation study.
C314	Ability to formulate testable hypotheses or answerable questions in a research or evaluation study.
C361	Knowledge of educational theories, practice, and terminology. This knowledge reflects a general acquaintance with established theories, terms, and practices used in the field of education.
C362	Knowledge of the objectives or learning sequences involved in a given curriculum or set of curriculum materials. This knowledge is prerequisite to designing, field testing, or critiquing a given curriculum or curriculum package.
C363	Knowledge of current theories of learning, especially as they relate to theories of instruction.
C364	Knowledge of specific socioeconomic or ethnic cultures.
C365	Knowledge of a foreign language or various English dialects.
C366	Ability to sequence learning activities to facilitate student learning in a curriculum or set of curriculum materials.

Competency Number	Competency Categories
C367	Knowledge of protocol materials and how they can be used and demonstrated.
C368	Ability to use field testing techniques during preliminary tryout or implementation of new curriculum materials.
C369	Ability to design or select curriculum materials to match the instructional "style" of the classroom for which they are intended.
C370	Knowledge of how to make use of various media and media resource personnel.
C371	Ability to draw or compose pictures or illustrations for curriculum materials.
C372	Ability to develop or organize a teacher's guide.
C373	Knowledge of sociology and/or sociological research methods.
C374	Knowledge of developmental psychology or the field of psychology in general. This competency requires either an understanding of child development (knowledge useful to a person who develops curriculum materials) or an understanding of any aspect of psychology listed by interviewees as necessary knowledge in their work.
C375	Ability to incorporate individualized instruction into the design of curriculum materials.
C376	Knowledge of procedures and steps in developing curriculum materials.
C377	Ability to organize recently developed educational materials to enable them to be distributed promptly upon request.
C378	Ability to use various media (TV, tapes, slides, pamphlets, etc.) to disseminate information on innovative educational practices or products.
C401	Knowledge of relevant subject matter. This competency refers to an understanding of a substantive field, including knowledge of major theories, well-known authors in the field, the current trends in the field, etc.

Competency Number	Competency Categories
C402	Knowledge of current educational innovations (e.g., individually prescribed instruction) and/or recent developments in the field of education. This competency relates to a knowledge of what is happening today in the field of education -- not necessarily an acquaintance with specifics of education, but an awareness of major innovations and major issues or occurrences in the field.
C403	Knowledge of classification systems of educational goals. This competency includes knowledge about taxonomies in the cognitive, affective and psychomotor domains.
C404	Ability to be creative.
C405	Ability to use analytical or logical skills. These skills would involve such abilities as breaking things down into component parts or perceiving logical contradictions.
C406	Ability to draw correct inferences, conclusions, or generalizations.
C407	Ability to recognize and use relationships among concepts, processes, or other phenomena.
C408	Ability to formulate a rationale to support a particular position or argument.
C409	Ability to evaluate or critique a written or oral presentation. This competency includes the ability to formulate constructive criticism when writing reviews, reading critically, etc.
C410	Knowledge of mathematical logic.
C411	Ability to apply abstract theory to concrete problems or situations.
C412	Ability to predict with accuracy the impact of an inquiry or inquiry-related activity.
C413	Ability to conceptualize or "brainstorm" new ideas. This is the general conceptual skill of initiating ideas one wishes to pursue.
C414	Knowledge of systems analysis concepts and techniques.

Competency Number	Competency Categories
C415	Ability to be open-minded. This competency could involve the ability to break a mental set or the ability to tolerate ambiguity.
C416	Ability to pinpoint important issues or themes.
C417	Ability to make long-range forecasts or predictions. This competency would include both the "crystal-ball" ability to think about the hypothetical or the improbable, and knowledge of formal methods of forecasting, such as the Delphi technique or the Cross Impact Matrix.
C418	Knowledge of strategies of educational change. This competency might include an acquaintance with theories of change, knowledge of how to use change agents or other factors to facilitate or induce change in a particular situation.
C419	Knowledge of ways in which educational policies are formulated.
C420	Knowledge of legalities related to inquiry or inquiry-related projects. Such legalities might include the rights of subjects being investigated in a research or evaluation study (e.g., constraints related to invasion of privacy statutes) or copyright laws, relating to curriculum materials produced on a development project.
C421	Ability to state objectives in measureable terms.
C422	Knowledge of various uses of the computer in education. An example of this competency would be knowledge of a system such as Computer Assisted Instruction (CAI).
C501	Knowledge of steps involved in the mass production of curriculum materials (e.g., reproduction and packaging processes).
C502	Knowledge of printing constraints and specifications. This competency would require knowledge of factors such as various type sizes or type faces and the ability to communicate specifications to the printer.
C503	Ability to make arrangements with publishers.
C504	Ability to arrange purchases of needed materials to conduct a project or administer an organization.

Competency Number	Competency Categories
C505	Knowledge of photographic processing or the technical aspects involved in the production of artwork. This would include a knowledge of such processes as silkscreening or color overlays.
C506	Ability to take photographs.
C507	Knowledge of design stages in developing audio-visual or multi-media materials.
C508	Ability to develop appropriate product specifications for new educational products and ability to determine when specifications are met well enough to warrant dissemination of the product.
C509	Knowledge of workshops and the flow of materials therein (in regard to the production of visual aids or other educational materials).
C541	Knowledge of instructional approaches that might be incorporated in teaching or designing instructional materials. This knowledge might include an acquaintance with various teaching models, such as discovery learning or the open classroom.
C542	Ability to assess students' attitudes toward an educational program, product, or practice. Such knowledge is potentially useful in designing or implementing curriculum materials as well as in evaluating them.
C543	Knowledge of the role of the teacher, including abilities which normally can be expected of teachers. Again, such knowledge would be of use to those developing, disseminating, or evaluating curriculum materials.
C544	Ability to make necessary arrangements for conducting in-service institutes or workshops.
C545	Ability to teach effectively. This competency refers to the ability to teach or demonstrate educational products or practices.
C546	Knowledge of parents' attitudes, abilities, and the informal academic training they give to their children.
C547	Knowledge of methods of teacher training.

Competency Number	Competency Categories
C548	Ability to use manipulative classroom teaching materials. Such materials would include laboratory equipment that students could use in learning elementary concepts of science, or building blocks or an abacus that might be used to teach basic math concepts to elementary children.
C549	Knowledge of appropriate instructional materials to be used with students at certain age levels.
C601	Ability to administer any type of project or program. (It was necessary to include such a broad competency as this because some interviewees could not break down their administrative skills into any further specifics.)
C602	Knowledge of organizational or management theory.
C603	Knowledge of inquiry or inquiry-related management. This refers to the specific knowledge of how to manage research or research-related projects.
C604	Knowledge of the role of inquiry and inquiry-related activities in education. This includes insight into what is meant by terms such as educational research, development, diffusion and evaluation and an understanding of how they relate to one another.
C605	Ability to develop an organization or organizational unit. This competency relates to the broad knowledge required to organize or set up a unit such as an R & D center and would include, for example, a knowledge of staffing plans.
C606	Knowledge of rational decision-making processes. This competency would include a knowledge of such aspects of administration as how to establish priorities or how to weight alternatives in making decisions.
C607	Knowledge of the organization for which you are working, including knowledge of its needs, resources, methods of operation, etc.
C608	Ability to supervise personnel. This broad competency relates to working with people who are responsible to you and would include assigning tasks, monitoring the work of individuals, motivating staff, providing guidance and leadership for these personnel, etc.

Competency Number	Competency Categories
C609	Knowledge of effective techniques for writing and submitting proposals to obtain funding. Included here would be a knowledge of the process one must follow in submitting proposals.
C610	Ability to identify and obtain resources needed to accomplish program objectives. Such resources could be financial or could involve necessary facilities, personnel, and so forth.
C611	Knowledge of personnel evaluation practices. This competency refers to (a) the ability to judge a person's potential value prior to employing him and (b) the ability to determine if an individual is performing adequately in his job.
C612	Ability to design a physical plant or plan the facilities needed for a program or project. This competency includes a knowledge of what kinds of physical needs are required to carry out inquiry or inquiry-related activities, and also involves the ability to translate space needs into physical plans.
C613	Ability to identify educational needs that should be addressed by educational systems.
C614	Ability to determine financial resources necessary to conduct a program or project and use accounting procedures to operate within a program or project budget.
C615	Ability to plan and/or coordinate activities for a program or project.
C616	Knowledge of and ability to use management and planning systems such as PERT (Program Evaluation and Review Technique), PPBS (Program Planning Budgeting System), or Critical Path Analysis.
C617	Knowledge of effective techniques of recruiting, interviewing and hiring personnel.
C618	Ability to "stick with a task" to its conclusion.
C619	Ability to work with small but important details of larger project activities.
C620	Ability to outline specific procedures for working through a problem.

Competency Number	Competency Categories
C621	Ability to "trouble shoot" or resolve problems in an ongoing project.
C622	Ability to facilitate staff work on an ongoing project.
C623	Ability to influence others to attain project or program objectives.
C624	Ability to handle routine professional correspondence and responsibilities.
C625	Ability to make progress assessments for ongoing activities.
C626	Ability to estimate realistically the time required for various inquiry and inquiry-related activities.
C627	Ability to maintain work schedules.
C628	Ability to conduct effective public relations.
C629	Ability to work effectively with decision makers. This skill would include the ability to press for an idea with supervisors or those in authority, as opposed to acquiescing when dealing with persons in authority.
C630	Knowledge of political considerations. This knowledge refers to an awareness of political factors within institutions, local communities, regions, or the nation.
C701	Knowledge of formal or informal systems of recording observations of behavior. This competency would include acquaintance with the purposes and operations of such formal systems as those designed by Flanders or Bellack.
C702	Ability to use formal or informal systems of recording observations of behavior. This skill would relate either to implementing such a system in an institution or to the actual coding of observations in the classroom.
C703	Ability to develop an observation system of coding behavior in the classroom.
C726	Ability to read, interpret, and follow an administration manual for standardized tests.
C727	Ability to present directions clearly in administering an instrument.

Competency Number	Competency Categories
C728	Ability to adjust test administration procedures when situational factors make such adjustment essential. An example of this competency would be the ability to adjust administration procedures in an individual testing situation when one determines a subject is not giving valid or reliable responses.
C729	Ability to establish rapport with children and obtain their cooperation in testing situations.
C801	Ability to choose (or design) appropriate statistical techniques for data analysis.
C802	Ability to manipulate data so as to extract all relevant information.
C803	Ability to determine the relevance of new information or educational materials for the field of education.
C804	General knowledge of statistics. This competency was coded only when a respondent could not delineate specific statistical skills but still mentioned he needed statistical knowledge in carrying out his work; it simply refers to a general understanding of the uses of statistics and acquaintance with some of the more commonly used techniques.
C805	Knowledge of descriptive statistical techniques.
C806	Knowledge of or ability to calculate various kinds of test scores or scoring procedures. Examples of such scores would be grade equivalent scores, stanine scores, or gain scores.
C807	Knowledge of ANOVA or ANCOVA designs and techniques.
C808	Knowledge of correlational techniques.
C809	Knowledge of multiple correlational techniques.
C810	Knowledge of statistical regression techniques.
C811	Knowledge of t-tests and critical ratios.
C812	Knowledge of statistical variance and standard deviation.
C813	Knowledge of instrument reliability including types of reliability coefficients.

Competency Number	Competency Categories
C814	Knowledge of or ability to determine instrument validity, including various approaches to determining validity.
C815	Knowledge of factor analytic techniques.
C816	Knowledge of distribution theory and distributions commonly used in statistics.
C817	Knowledge of non-parametric statistical techniques.
C818	Knowledge of methodology for inferring causation from non-experimental data.
C819	Knowledge of theoretical assumptions underlying various statistical techniques.
C820	Ability to use printed statistical tables (e.g., random number tables).
C821	Ability to interpret and integrate statistical data into a meaningful presentation.
C822	Knowledge of alternate methods of presenting statistical data (e.g., charts, graphs, or tables).
C823	Ability to organize and classify information into meaningful categories.
C824	Knowledge of how computers might be used to analyze data.
C825	Ability to allocate time and money wisely in arranging computer work.
C826	Ability to design card layouts to allow data analysis within computer constraints and ability to use standardized computer programs (e.g., BMD series).
C827	Ability to write computer programs.
C828	Knowledge of capabilities of local computer systems.
C829	Ability to use computer tapes or discs.
C830	Ability to use computer coding.
C831	Ability to keypunch.

Competency Number	Competency Categories
C832	Ability to read and interpret computer output.
C833	Ability to use or design computer simulation, modeling, or graphics.
C834	Knowledge of philosophy of science.
C835	Ability to use computer-related equipment such as sorters, reproducers, or automatic test scoring machines.
C836	Knowledge of econometrics.
C901	Knowledge of various stages in the research process. This competency refers to knowing what tasks must be engaged in to carry out a research project (e.g., problem delineation, collecting data) as opposed to actually knowing how to conduct each stage.
C902	Knowledge of group dynamics or skills of verbal interaction. This competency refers to the ability to lead group discussions, moderate meetings of any work team, and facilitate constructive interactions among personnel.
C903	Knowledge of connotations of words. This competency refers to the ability to avoid attaching an unintended connotation or any imprecise meaning to words in either oral or written communication.
C904	Ability to identify or obtain cooperation from needed resource persons or consultants.
C905	Ability to use consultants effectively. This includes the ability to obtain needed information or suggestions from consultants.
C906	Ability to establish working relationships with other groups or agencies.
C907	Ability to keep up-to-date with new developments in one's field through reading.
C908	Ability to keep up-to-date with new developments in one's field through communication with other persons in the field.
C909	Knowledge of security problems (e.g., confidentiality) involved in using and storing instruments and data.

Competency Number	Competency Categories
C910	Knowledge of school finance.
C911	Ability to use library research techniques. This competency refers to the ability to locate information in a library and would include acquaintance with relevant periodical indices.
C912	Ability to use ERIC or other information retrieval systems.
C913	Ability to develop and apply an effective system for summarizing and recording information obtained through a manual search of library sources and references. This skill relates to the use of systematic ways to record notes, such as index cards and/or filing systems.
C914	Ability to operate or use audio-visual aids.
C915	Knowledge of policies and procedures of local, state, or Federal agencies which facilitate or support inquiry and inquiry-related activities.
C916	Knowledge of how to advertise recently-developed educational materials. This competency includes knowledge of market research techniques and the ability to utilize such methods.
C917	General speaking skills. This competency relates to the general ability to communicate orally in a clear and effective fashion.
C918	Ability to respond extemporaneously to oral questions. Included would be the general ability to respond to questions in any situation (e.g., a TV interview).
C919	Ability to maintain audience interest in an oral presentation.
C920	Ability to "read the audience" and modify an oral presentation accordingly.
C001	Ability to write. This is the general ability to communicate written information coherently.
C002	Ability to revise and rewrite. This writing skill includes the ability to refine previous writing, deleting, modifying, or adding written material where necessary.
C003	Ability to edit one's own writing or that of others. This competency requires the ability to proofread, a knowledge of grammar and spelling, and the ability to detect errors in grammar and spelling.
C004	Ability to synthesize or summarize.

Competency Number	Competency Categories
C005	Ability to maintain a consistent style in a written document. Consistency of style would include maintaining the same level of language difficulty, the same degree of specificity, or the same general attitude throughout any one written document.
C006	Ability to determine an appropriate scope in any written work. This competency includes the ability to determine how broad a focus to take in any writing task.
C007	Ability to write macro-scenarios. This skill might be described as a "story-writing ability" and would be utilized by someone writing curriculum materials or certain kinds of historical or philosophical analyses.
C008	Knowledge of which professional journals might publish a given article.
C009	Ability to put quantitative or numerical information into verbal or narrative form. This skill involves translating data into meaningful narrative, as in reporting a summary of findings from a research or evaluation study.
C010	Ability to write in a style and at a level appropriate to a specified audience. This competency requires (a) a knowledge of the audience's point of view, preferences, level of understanding, etc., and (b) the ability to use such knowledge in choosing an appropriate style or level of communication for transmitting information to that audience.
C011	Ability to write in an objective, unbiased manner. This competency involves an awareness of of "scientific" communication, where emphasis is placed on objectivity and evidential test.
C012	Ability to write for practitioners. This skill refers to the ability to write in a non-technical fashion, perhaps purposely avoiding technical terms, in order to communicate to persons such as public school teachers or administrators.
C013	Ability to write in an interesting or appealing style. This might require the use of humor, conflict, or any technique which increases interest without sacrificing communication.
C014	Ability to organize ideas. This competency refers to such aspects of writing as the ability to outline, the ability to focus on one point at a time, or the ability to logically organize elements of writing.

Competency Number	Competency Categories
C015	Ability to write clearly and/or concisely. Included in this skill would be a knowledge of good sentence construction and the ability to use words and phrases which communicate clearly.
C016	Ability to write as a member of a team.
C017	Ability to describe, explain, or elaborate in writing.
C018	Knowledge of alternate sources of funding for a proposal and requirements for writing proposals appropriate for each source.* This competency comes into play when one is writing a proposal to obtain funding and would include a knowledge of the preferences of the funding agency as they relate to the proposed study and the ability to use written communication to influence the funding agency to approve the proposal -- i.e., "grantsmanship."
C019	Ability to document or support a written statement. This competency would include not only the ability to use direct quotes in writing, but also the ability to use bona fide examples in backing up an argument.

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*Competency 018 may also be categorized under several other general competency categories since it includes much more than simply "writing skills." It is included here, however, in the first relevant category which is discussed. Similarly, other competencies which might fit in several categories will be listed in the first relevant category which appears in this list.

APPENDIX E

RESULTS OF STATISTICAL ANALYSES

TABLE E1

Correlations Among Tasks

TASK	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
T1	(630)	497	143	099	121	056	045	043	139	-087	004	-042
T2		(738)	026	277	086	018	-072	012	063	[illegible]5	003	-071
T3			(689)	107	091	380	061	054	033	-079	017	054
T4				(667)	078	-032	-097	-065	-222	013	116	-179
T5					(727)	073	-186	569	024	-112	186	158
T6						(703)	055	032	098	-014	004	118
T7							(768)	-142	527	392	077	-101
T8								(738)	-023	-034	064	150
T9									(780)	316	045	-023
T10										(677)	-071	-089
T11											(699)	107
T12												(693)
T13												
T14												
T15												
T16												
T17												
T18												
T19												
T20												
T21												
T22												
T23												
T24												
T25												
T26												
T27												
T28												
T29												
T30												
T31												
T32												
T33												
T34												
T35												
T36												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E1

Correlations Among Tasks

TASK	TASK											
	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24
T1	-043	056	-022	-040	108	-057	-114	-111	114	-055	043	011
T2	127	-063	-037	-198	095	-134	-126	062	035	-083	-071	-004
T3	-073	183	068	013	023	011	043	-184	091	216	-031	159
T4	023	236	055	137	089	031	004	-024	-112	-108	-179	-018
T5	205	269	281	060	-033	002	-072	130	353	094	203	065
T6	-010	068	179	-101	213	-103	-102	-123	120	-026	075	099
T7	-067	-072	018	034	-091	-030	010	-212	031	-111	-101	-019
T8	249	085	227	045	-022	-047	025	217	327	032	103	004
T9	067	003	048	-211	-048	-022	069	-006	009	-086	-023	-032
T10	-006	-005	137	-007	-095	015	-015	216	-094	-017	-034	-030
T11	186	200	013	290	-063	079	-029	-049	220	-080	-150	093
T12	295	249	390	094	-022	160	195	078	327	226	245	323
T13	(623)	150	321	060	-033	136	091	130	109	000	021	065
T14		(734)	337	228	075	258	222	089	259	165	249	179
T15			(629)	086	052	103	193	264	322	190	309	217
T16				(616)	094	115	042	-025	169	018	045	022
T17					(569)	076	124	-127	104	-013	177	-058
T18						(760)	659	009	060	-105	-047	027
T19							(791)	097	-042	-051	025	073
T20								(672)	207	247	171	071
T21									(684)	108	159	148
T22										(697)	371	261
T23											(712)	243
T24												(670)
T25												
T26												
T27												
T28												
T29												
T30												
T31												
T32												
T33												
T34												
T35												
T36												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E1

Correlations Among Tasks

TASK	TASK											
	T25	T26	T27	T28	T29	T30	T31	T32	T33	T34	T35	T36
T1	070	-021	043	-070	007	-054	-061	106	-050	-002	079	046
T2	-006	-044	082	-096	-019	-126	-075	-017	-054	046	006	-036
T3	083	-013	-070	-150	-170	-098	-056	110	153	050	037	024
T4	-077	-112	178	-093	-203	-104	-114	-068	-119	-143	-045	-147
T5	295	278	049	411	153	133	065	-099	017	-104	-046	013
T6	-049	-048	002	-133	-107	-084	-192	117	259	198	206	168
T7	147	-066	-110	-166	-045	-197	-019	-136	345	252	323	424
T8	260	313	-061	457	291	220	084	-093	022	021	-021	-059
T9	070	-077	-040	-154	-130	-169	042	-108	387	152	339	488
T10	-056	-192	-152	-113	-097	-186	-030	-073	189	152	259	249
T11	175	096	-124	220	212	167	021	-117	092	020	045	077
T12	043	-077	071	058	-070	049	004	034	106	-071	090	-101
T13	130	062	-079	170	003	078	065	024	219	073	008	013
T14	009	-081	166	-053	-196	-012	110	190	025	-167	-032	-251
T15	011	-029	-042	022	-067	043	-057	171	160	-111	067	054
T16	-002	005	-042	092	-149	018	-144	046	-015	-130	-053	-052
T17	036	026	-073	-109	005	-089	-058	233	-165	063	-092	-004
T18	029	023	-014	-022	-158	-052	-089	132	-068	-131	023	-090
T19	058	091	-087	048	-124	-004	-070	187	104	-073	091	-138
T20	057	126	-203	133	-037	032	-007	-097	114	-004	017	-091
T21	212	170	-082	233	136	040	077	-011	086	-094	-029	-006
T22	028	053	-184	029	001	243	342	172	141	-047	-061	-111
T23	000	090	-061	058	085	049	243	288	-103	-116	-077	023
T24	-042	-024	018	-056	-133	079	060	170	001	-012	258	051
T25	(744)	472	-052	471	280	185	104	-113	122	337	216	109
T26		(852)	-069	662	460	293	164	-071	013	116	-120	-115
T27			(594)	-105	-094	-062	-093	-056	-146	-143	009	-110
T28				(851)	556	389	280	-084	-045	122	-045	-079
T29					(774)	296	388	-080	-056	253	-088	-135
T30						(666)	368	239	-069	-032	-045	-097
T31							(768)	170	071	065	-118	-158
T32								(572)	-126	-099	-071	-136
T33									(691)	260	261	271
T34										(721)	439	173
T35											(768)	421
T36												(776)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estiamtes of communality in the factor analysis. Leading decimal points are omitted.

TABLE E1

Correlations Among Tasks

TASK	T37	T38	T39	T40	T41	T42	T43	T44	T45	T46	T47	T48
T1	005	-070	-204	-008	048	-025	-070	-070	153	213	048	028
T2	048	168	-140	096	025	080	-008	-052	066	020	-111	-052
T3	-051	-061	-061	-005	056	164	-016	-150	016	153	146	099
T4	-052	148	-093	-068	-104	148	208	-093	-018	-018	-101	-042
T5	-198	-071	-023	-099	-032	-119	170	170	-166	-024	-178	-187
T6	023	-042	140	233	124	094	003	-133	-047	374	168	-020
T7	090	095	182	086	152	052	-035	008	120	198	162	183
T8	-047	-142	008	034	-065	-192	-042	207	004	064	-103	-103
T9	042	172	358	129	150	079	079	-061	116	153	110	064
T10	174	175	117	-073	013	060	-113	002	-030	092	106	195
T11	079	039	-006	-117	-040	039	-006	129	021	092	068	-091
T12	-116	-042	008	-093	-065	-142	-092	008	-075	106	-053	041
T13	-064	074	026	024	-087	-071	074	026	-089	179	-083	091
T14	-041	033	-096	-141	-111	-140	-010	-096	-028	025	-070	-141
T15	-015	065	-020	-157	-055	-192	-020	022	-193	016	-125	-048
T16	-100	-011	-063	-086	-041	-063	-063	041	-061	-015	-022	137
T17	-069	-109	-005	233	-089	-109	100	-109	-058	100	-112	-066
T18	-005	197	051	-053	-052	-094	124	-167	027	-068	-028	005
T19	041	048	048	-042	-004	-041	138	-131	073	-046	-046	-079
T20	076	133	036	-097	-024	-110	-110	182	-085	-050	-169	-113
T21	-124	010	-034	-124	-011	-212	-167	099	-136	160	038	-106
T22	-034	-124	-073	-088	068	-124	-073	132	016	055	-033	055
T23	-047	-042	-142	-093	049	-291	008	058	-155	-062	-053	-031
T24	-089	112	-056	-045	079	-140	-056	-056	060	213	104	037
T25	092	059	-033	004	133	-033	104	150	031	160	-002	052
T26	104	073	-103	230	158	-045	250	309	-024	-036	005	-133
T27	-014	-035	-035	-056	-142	-035	105	-035	018	-087	-042	-004
T28	051	052	000	050	088	-158	105	526	-056	-043	-011	-083
T29	218	-032	-032	059	047	-195	022	512	-046	-010	119	-150
T30	-052	-093	-093	086	172	-093	027	449	-018	-018	077	-042
T31	027	-056	028	-045	079	-140	028	364	-075	-141	022	-084
T32	-053	-084	-084	-027	086	-084	-084	-084	-045	-126	046	-051
T33	176	090	267	-014	184	178	-043	134	071	294	116	144
T34	402	074	267	269	189	026	-023	170	219	300	155	091
T35	104	132	191	-071	158	073	014	-045	-024	360	121	122
T36	030	269	357	086	202	052	095	-122	-019	235	119	057

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E1

Correlations Among Tasks

TASK	T49	T50	T51	T52	T53	T54	T55	T56	T57	T58	T59	T60
T1	161	-122	157	-057	204	100	-038	288	-040	-098	111	-014
T2	080	-129	073	-013	157	131	024	212	062	063	037	037
T3	252	-120	210	-051	193	002	-033	299	-031	-126	038	059
T4	-076	-068	-047	-052	109	-119	-106	088	-101	-063	-073	-030
T5	-196	-099	-106	-131	-079	024	091	-023	-035	024	189	-104
T6	246	-115	093	-103	212	-008	-179	140	033	-063	060	002
T7	255	-136	136	-150	-004	234	010	095	-095	-050	087	-045
T8	-155	-093	-142	-185	-254	-062	-144	-092	-053	021	090	-014
T9	140	-108	181	-151	097	153	069	079	110	096	051	-052
T10	132	-073	106	-065	-122	237	083	060	-064	113	119	045
T11	-110	-117	039	-171	-019	-060	-106	-051	023	-035	-035	-004
T12	011	161	023	091	-032	022	-060	058	143	065	184	136
T13	046	-099	-027	-064	-036	-024	-073	074	-035	-019	098	188
T14	-172	-141	-072	-101	-020	-061	001	163	-070	-035	148	076
T15	-073	-047	-088	-134	-028	160	047	022	086	199	246	-020
T16	-068	-086	034	-028	018	028	-134	-063	-176	-120	-063	-075
T17	008	-035	-177	-069	138	-077	-054	-005	094	230	-026	-062
T18	048	-053	-150	-106	-048	054	041	051	-100	-022	152	-095
T19	024	-042	-064	-083	-154	-046	087	-041	042	148	103	-074
T20	-019	027	070	076	-092	073	097	-061	023	167	157	048
T21	-040	-124	-006	-124	135	123	034	099	-093	126	100	-019
T22	045	172	-069	107	-060	-074	036	-022	118	049	-027	152
T23	-071	161	-183	022	-076	190	110	108	045	197	044	061
T24	-004	170	-019	027	027	071	-070	028	022	116	-001	-080
T25	-006	-113	033	-224	-125	006	-097	059	-137	-132	286	077
T26	006	-071	-017	-140	-140	-135	-010	-014	-111	-129	025	053
T27	-093	-056	-052	082	096	089	032	035	027	-102	-002	-099
T28	-184	-084	008	-094	-230	-043	-041	-053	-011	-061	096	010
T29	-110	-080	000	-158	-218	-010	-031	-087	119	063	-028	188
T30	-126	-068	-097	-052	-160	-018	099	-154	137	-063	-073	061
T31	-145	-045	051	-089	-122	-070	073	-056	104	-107	-001	302
T32	-017	-027	-136	-053	106	-014	-042	-084	046	010	-095	-048
T33	242	-126	308	-068	067	-003	-122	090	-059	-160	255	042
T34	288	-099	173	069	-122	-064	-155	-071	060	-061	144	042
T35	203	-071	129	023	-140	013	-110	-045	005	-025	025	-126
T36	219	-136	064	-090	151	162	-064	095	034	065	047	-111

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E1

Correlations Among Tasks

TASK	TASK T61	T62	T63	T64	T65	T66	T67	T68	T69
T1	-054	-157	-163	-099	106	-042	-122	-036	-190
T2	098	-177	-121	-105	208	144	096	-055	-051
T3	046	056	-190	043	-005	-039	-120	201	033
T4	-025	-035	-077	-055	239	188	086	006	099
T5	088	-087	127	-081	-099	-115	-099	-031	009
T6	-120	-084	-207	048	-115	-133	-115	216	-102
T7	071	252	223	-111	-025	-061	-025	-073	-064
T8	071	-122	000	080	034	003	034	053	025
T9	047	097	192	057	-108	-126	-108	062	-089
T10	187	145	195	120	074	043	074	-085	083
T11	009	064	214	045	-117	-136	-117	034	-029
T12	324	-008	-261	-075	034	-108	-093	-011	110
T13	186	-032	043	-081	024	-008	024	-093	091
T14	097	087	009	-115	-031	-068	-141	-030	075
T15	174	-006	011	-127	-047	-087	-047	-012	047
T16	-053	077	043	-070	046	-100	-086	-122	-046
T17	000	-089	-056	-028	-035	-040	-035	-076	-054
T18	133	364	029	-043	-053	-062	-053	-023	041
T19	236	304	136	-034	-042	-048	-042	024	239
T20	050	-024	100	072	027	103	151	101	260
T21	027	091	-136	-101	-011	-045	-011	071	034
T22	197	-108	-061	-072	-088	011	042	070	036
T23	172	-179	000	-075	-093	-108	-093	053	109
T24	034	-018	031	-036	-045	-052	-045	226	073
T25	028	080	123	-092	-113	-131	-113	107	-097
T26	-036	023	267	126	-071	-082	-071	-078	091
T27	-028	-142	-235	-045	123	-065	-056	-122	-087
T28	011	-033	150	095	-084	-097	-084	-048	048
T29	-077	-078	186	274	-080	-092	-080	-034	-124
T30	037	-104	080	-055	-068	-079	-068	006	099
T31	120	-018	178	225	-045	-052	-045	010	073
T32	-082	-068	-113	-022	-027	-031	-027	114	-042
T33	018	184	122	-103	-126	-147	-126	065	-046
T34	-108	023	169	219	024	-115	-099	154	-073
T35	024	023	164	-057	-071	-082	-071	149	-010
T36	-062	-097	109	-111	-136	-158	-136	150	-138

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E1

Correlations Among Tasks

TASK	T37	T38	T39	T40	T41	T42	T43	T44	T45	T46	T47	T48
T37	(797)	197	197	132	114	-094	-094	-022	492	054	187	-100
T38		(733)	210	184	208	000	158	052	-056	-087	041	-007
T39			(684)	184	148	000	105	-106	028	134	092	-083
T40				(665)	239	-084	184	050	170	099	046	-051
T41					(560)	208	148	088	079	033	256	045
T42						(645)	000	-106	028	090	-063	145
T43							(612)	-053	-140	-132	-167	-083
T44								(758)	-056	-087	-115	-083
T45									(729)	142	187	-084
T46										(802)	290	208
T47											(579)	137
T48												(552)
T49												
T50												
T51												
T52												
T53												
T54												
T55												
T56												
T57												
T58												
T59												
T60												
T61												
T62												
T63												
T64												
T65												
T66												
T67												
T68												
T69												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E1

Correlations Among Tasks

TASK	T49	T50	T51	T52	T53	T54	T55	T56	T57	T58	T59	T60
T37	170	-053	090	-005	-113	-068	-083	-022	-100	-087	220	235
T38	-008	-084	008	-167	-089	001	-131	158	-011	-061	195	010
T39	212	-084	-079	051	051	001	-131	-211	092	-014	047	-070
T40	-017	-027	-136	-053	-133	-126	-042	-084	046	-108	-095	-048
T41	025	-068	052	-135	-106	-018	099	027	-101	-009	153	-030
T42	080	-084	182	-094	145	-220	-131	000	041	-061	-052	-070
T43	-184	-084	-209	-094	-089	-043	138	000	-011	-107	145	-070
T44	-184	-084	095	-094	-183	134	138	000	092	-014	-003	010
T45	136	-045	120	027	027	-070	-070	-056	022	-181	077	-080
T46	538	-126	235	115	146	146	-197	178	-102	-081	172	042
T47	322	-086	291	-028	018	072	-046	092	-022	-028	-015	160
T48	329	143	120	214	065	144	-079	069	-163	-137	034	140
T49	(820)	-017	401	291	275	168	-126	168	-068	-171	078	104
T50		(599)	-136	503	-133	-126	-042	-084	-086	010	-095	-048
T51			(709)	151	151	089	084	182	-009	-127	169	285
T52				(720)	-048	-068	041	-022	-100	-087	015	015
T53					(682)	186	006	098	064	-027	069	-095
T54						(754)	254	311	072	075	048	109
T55							(583)	-041	042	148	103	-074
T56								(608)	-167	-014	145	249
T57									(655)	384	-063	003
T58										(729)	-036	-052
T59											(654)	054
T60												(666)
T61												
T62												
T63												
T64												
T65												
T66												
T67												
T68												
T69												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E1

Correlations Among Tasks

TASK	TASK T61	T62	T63	T64	T65	T66	T67	T68	T69
T37	-089	-052	029	183	132	-062	-053	-023	-083
T38	-096	148	059	-068	-084	-097	-084	155	048
T39	-203	148	059	095	050	-097	-084	222	048
T40	-082	-068	-113	-022	-027	-031	-027	-058	-042
T41	-025	034	185	-055	-068	-079	-068	238	-004
T42	011	088	150	-068	050	019	-084	087	-041
T43	064	-033	196	-068	-084	-097	-084	-048	048
T44	011	-093	196	095	-084	-097	-084	-116	048
T45	-051	-114	-042	036	170	-052	-045	118	-070
T46	-027	-018	-109	-103	-126	-147	-126	178	-046
T47	-053	-041	-002	252	-086	-100	-086	211	042
T48	077	045	-014	-041	-051	-059	-051	-013	-079
T49	054	-025	-006	032	-017	-149	-129	171	024
T50	055	-068	-113	-022	-027	-031	-027	-058	-042
T51	115	052	-005	160	-025	-158	-136	038	010
T52	-051	-052	-161	-043	132	-062	-053	-116	041
T53	-057	055	-125	086	106	019	-014	111	-074
T54	108	-018	006	035	-126	-147	-126	121	-046
T55	236	-004	136	-034	-042	-048	-042	-091	239
T56	118	027	-079	-068	-084	-097	-084	-048	-131
T57	158	-041	-002	091	178	130	046	078	042
T58	142	-009	192	201	129	184	129	003	148
T59	110	153	072	-077	031	-110	-095	-018	020
T60	178	-121	-062	209	-048	-055	-048	-104	061
T61	(556)	-025	121	-067	055	024	055	-110	236
T62		(654)	080	-055	-068	-079	-068	-149	-004
T63			(744)	193	-113	-130	-113	-011	136
T64				(696)	-022	-025	-022	163	-034
T65					(763)	564	315	-058	187
T66						(914)	862	-068	150
T67							(881)	-058	187
T68								(616)	024
T69									(575)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E2

Competencies in Package 01

COMPETENCY NUMBER			
C201	C223	C729	C817
C202	C301	C801	C819
C203	C302	C802	C821
C204	C303	C803	C822
C205	C304	C804	C823
C206	C305	C805	C824
C207	C306	C806	C825
C208	C307	C807	C826
C209	C308	C808	C827
C210	C309	C810	C828
C211	C313	C811	C830
C212	C314	C812	C831
C215	C701	C813	C832
C217	C702	C814	C834
C218	C726	C815	C911
C221	C728	C816	C912

TABLE E3

Competencies in Package 02

COMPETENCY NUMBER			
C101	C403	C609	C906
C102	C405	C610	C910
C103	C406	C611	C911
C104	C407	C613	C912
C105	C408	C614	C915
C106	C409	C615	C917
C107	C413	C616	C001
C108	C414	C617	C002
C109	C415	C620	C003
C110	C416	C622	C004
C111	C417	C625	C009
C112	C418	C626	C010
C113	C420	C627	C011
C114	C421	C628	C012
C115	C603	C629	C013
C116	C604	C630	C014
C118	C605	C902	C015
C119	C606	C903	C017
C401	C607	C904	C018
C402	C608	C905	C019

TABLE E4

Competencies in Package 03

COMPETENCY NUMBER				
C310	C405	C541	C620	C917
C312	C406	C542	C622	C001
C361	C407	C543	C625	C002
C363	C408	C545	C626	C003
C364	C409	C547	C627	C004
C366	C411	C603	C628	C005
C368	C412	C604	C629	C006
C371	C413	C606	C630	C009
C372	C414	C608	C905	C010
C373	C415	C610	C907	C011
C374	C418	C611	C908	C012
C375	C421	C613	C910	C013
C376	C501	C614	C911	C014
C378	C502	C615	C912	C015
C401	C506	C616	C914	C016
C402	C507	C617	C915	C017
C404	C508	C618	C916	C018

TABLE E5

Correlations Among Package 01 Competencies

COMPE-TENCY	COMPETENCY C201	C202	C203	C204	C205	C206	C207	C208	C209	C210	C211
C201	(696)	041	055	218	202	144	166	-034	-148	046	317
C202		(686)	323	269	177	168	336	197	031	-030	247
C203			(587)	060	015	-027	146	-094	-020	046	086
C204				(703)	217	075	301	259	095	038	341
C205					(669)	219	091	015	-105	-068	229
C206						(721)	374	431	015	-014	076
C207							(658)	374	137	089	187
C208								(814)	263	046	008
C209									(771)	221	-112
C210										(673)	173
C211											(797)
C212											
C215											
C217											
C218											
C221											
C223											
C301											
C302											
C303											
C304											
C305											
C306											
C307											
C308											
C309											
C313											
C314											
C701											
C702											
C726											
C728											
C729											
C801											
C802											
C803											

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E5

Correlations Among Package 01 Competencies

COMPETENCY	C212	C215	C217	C218	C221	C223	C301	C302	C303	C304	C305
C201	082	351	192	-024	296	188	125	-024	058	253	145
C202	031	166	-038	070	221	120	247	-030	031	236	063
C203	-020	026	-104	046	030	-040	165	-127	035	-018	017
C204	152	293	200	354	257	249	056	144	043	246	211
C205	238	115	134	-005	215	185	287	375	246	149	211
C206	330	272	038	058	246	131	141	204	074	224	165
C207	203	250	176	029	349	149	133	029	000	369	256
C208	169	141	198	307	196	133	086	133	-035	244	291
C209	106	-009	135	295	-021	-004	-112	146	-031	080	008
C210	-004	062	019	104	-118	311	-076	-034	042	074	181
C211	361	353	197	048	142	297	103	-014	-076	178	193
C212	(679)	189	309	146	194	146	023	146	092	192	186
C215		(795)	431	153	307	153	188	-120	056	210	181
C217			(679)	099	232	019	052	-141	065	306	234
C218				(786)	014	104	-076	-034	155	-030	181
C221					(589)	014	202	-052	121	336	092
C223						(665)	-076	-034	042	126	126
C301							(629)	110	127	131	095
C302								(683)	099	022	126
C303									(600)	064	178
C304										(666)	514
C305											(772)
C306											
C307											
C308											
C309											
C313											
C314											
C701											
C702											
C726											
C728											
C729											
C801											
C802											
C803											

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E5

Correlations Among Package 01 Competencies

COMPETENCY	C306	C307	C308	C309	C313	C314	C701	C702	C726	C728	C729
C201	033	104	145	192	082	-081	-015	072	-010	144	-034
C202	223	-057	142	070	-036	-014	092	177	063	260	-055
C203	128	-005	-121	172	-059	-157	-034	095	-084	125	015
C204	180	117	295	311	-109	-021	056	217	-036	259	126
C205	168	-019	060	139	022	091	137	186	-040	254	-144
C206	160	184	222	215	164	-070	069	086	301	065	-118
C207	108	159	161	132	105	-051	166	147	197	222	-081
C208	128	146	360	302	022	071	144	015	280	015	015
C209	078	137	186	072	-029	007	082	169	317	169	546
C210	162	089	-092	-037	004	-031	188	058	-017	046	133
C211	147	187	095	121	-221	024	125	115	042	165	086
C212	078	268	127	072	-029	007	005	169	212	169	169
C215	226	329	326	203	124	011	-023	115	303	255	-089
C217	188	316	297	178	-005	176	-054	134	243	400	198
C218	-037	089	236	273	-060	149	-024	-005	080	133	394
C221	213	234	196	227	168	-053	228	094	247	279	-053
C223	-037	-091	181	015	-125	-031	188	-005	080	046	046
C301	192	024	-003	168	187	024	-066	-056	-045	008	-149
C302	113	-031	181	015	198	149	046	058	-113	-127	-127
C303	102	-049	045	263	000	049	058	-013	079	177	106
C304	335	369	350	242	-075	-039	094	149	172	178	-018
C305	249	351	266	336	-077	161	033	010	-016	154	017
C306	(691)	282	249	206	097	152	033	168	058	316	065
C307		(722)	256	357	105	054	043	202	281	146	071
C308			(679)	173	-026	161	-023	-040	213	223	017
C309				(715)	-035	042	192	139	094	172	041
C313					(641)	049	016	-096	056	-059	-140
C314						(565)	-019	-019	-139	071	071
C701							(756)	331	187	055	-123
C702								(709)	137	414	175
C726									(756)	159	159
C728										(799)	343
C729											(792)
C801											
C802											
C803											

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E5

Correlations Among Package 01 Competencies

COMPETENCY	COMPETENCY										
	C801	C802	C803	C804	C805	C806	C807	C808	C810	C811	C812
C201	316	005	041	263	154	016	462	221	281	466	164
C202	252	-078	201	176	159	334	072	095	011	-023	100
C203	119	-114	197	185	092	086	-035	-041	-059	-114	141
C204	221	-020	231	141	311	293	301	327	286	152	223
C205	447	-037	085	207	020	046	349	182	082	238	031
C206	232	173	115	012	-001	270	252	007	028	173	-015
C207	244	072	074	107	269	291	295	136	105	072	170
C208	119	263	071	-013	162	378	248	310	104	075	026
C209	-083	-056	-023	-083	075	036	031	023	041	-137	090
C210	-022	071	070	-022	025	-070	211	034	004	146	-029
C211	282	091	111	141	404	246	279	156	128	158	271
C212	201	269	-023	087	075	288	153	023	-099	188	-009
C215	286	090	100	216	335	203	205	344	294	189	277
C217	193	048	-038	132	179	059	196	187	070	135	007
C218	083	071	120	-022	080	239	042	312	198	071	062
C221	297	051	078	147	312	212	282	271	168	265	133
C223	030	-004	170	187	190	162	099	145	069	295	244
C301	377	-044	066	188	006	037	229	066	070	091	106
C302	187	071	070	030	-030	007	155	-022	004	-004	062
C303	288	-092	-051	288	-034	-016	126	159	053	092	-019
C304	389	192	047	350	201	218	445	175	070	249	210
C305	488	245	063	157	194	270	445	296	127	186	326
C306	353	187	186	239	148	103	305	044	143	187	094
C307	198	333	-057	-030	124	156	197	184	218	203	250
C308	157	127	063	157	150	148	178	208	178	127	181
C309	374	184	220	139	230	152	306	288	158	184	203
C313	079	111	011	030	034	-017	000	043	154	-029	-047
C314	-030	072	-188	-030	-116	-047	000	039	105	-124	-069
C701	-006	005	-011	-006	154	175	173	106	016	236	071
C702	-082	-174	085	-034	070	117	090	-073	-155	-037	-053
C726	033	108	-077	033	220	227	000	150	056	212	-079
C728	119	-114	071	053	231	086	248	169	104	169	141
C729	-078	-114	-055	-013	092	-012	-035	-041	022	-114	026
C801	(785)	257	063	325	172	226	459	229	275	257	286
C802		(737)	-023	030	075	204	153	204	251	188	189
C803			(507)	025	159	166	-010	-026	-129	031	-033

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E5

Correlations Among Package 01 Competencies

COMPETENCY	C813	C814	C815	C816	C817	C819	C821	C822	C823	C824	C825
C201	075	043	236	275	312	240	289	227	-011	043	-101
C202	273	205	-023	143	099	137	114	055	048	161	244
C203	194	146	-020	-123	038	232	128	-068	-153	-081	051
C204	424	347	381	164	227	227	218	168	-006	163	-013
C205	165	091	376	072	170	047	168	179	-009	368	069
C206	153	247	015	218	119	002	265	250	002	247	118
C207	373	264	137	166	075	226	282	035	-147	054	139
C208	340	374	169	412	038	001	191	200	155	222	180
C209	109	072	025	-071	-086	-052	-084	-128	-052	-059	-094
C210	118	029	-004	-024	024	038	-087	046	161	029	-003
C211	202	187	158	125	279	145	282	305	-020	133	154
C212	109	072	188	159	060	148	187	160	-052	072	240
C215	374	250	288	164	410	341	292	371	179	-069	-074
C217	282	246	309	275	245	115	072	085	044	-034	-086
C218	291	210	445	046	092	161	162	152	038	270	100
C221	197	176	194	296	389	189	213	115	072	-054	-014
C223	233	089	071	188	092	038	063	312	161	270	100
C301	150	079	091	125	157	090	102	065	090	024	-030
C302	060	029	146	-024	024	-023	063	-060	-084	149	-003
C303	-035	098	153	058	247	-037	020	054	012	049	021
C304	224	278	136	253	157	206	260	221	068	097	-023
C305	208	256	304	257	215	274	288	183	-113	066	006
C306	054	065	241	085	188	260	171	120	127	021	-057
C307	122	212	137	166	193	333	282	221	013	-156	-040
C308	253	256	363	201	215	128	209	183	128	209	-075
C309	213	357	240	192	401	195	244	208	-034	042	050
C313	019	-064	-029	016	057	174	143	-201	059	-120	-116
C314	-030	-103	137	-019	075	066	-110	035	-040	054	-129
C701	253	166	159	130	-033	052	-069	064	-011	104	109
C702	059	091	101	-123	046	-009	-061	-016	103	-019	-025
C726	172	113	004	088	071	-050	197	192	206	029	074
C728	194	146	358	055	293	155	191	133	155	-005	051
C729	049	071	-020	-123	038	-076	-061	-135	001	-157	-078
C801	367	427	314	316	269	402	315	235	-108	198	137
C802	109	137	106	312	060	479	349	333	015	072	351
C803	064	-014	031	-011	099	092	042	055	048	117	021

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E5

Correlations Among Package 01 Competencies

COMPETENCY	COMPETENCY								
	C826	C827	C828	C830	C831	C832	C834	C911	C912
C201	216	085	161	058	174	069	164	-113	-050
C202	099	166	078	041	245	115	166	-162	-118
C203	-012	056	-053	-034	038	065	026	-181	-030
C204	328	086	106	164	330	075	084	-075	-248
C205	353	069	034	137	108	019	-053	085	049
C206	173	039	038	144	190	158	-112	010	-097
C207	146	134	-054	166	134	247	011	-057	-039
C208	213	056	030	412	377	339	-089	-055	-101
C209	-065	-009	-092	005	-086	173	-009	031	-085
C210	-039	-047	-118	046	-043	-014	062	020	-006
C211	281	162	202	189	400	141	271	-250	-222
C212	128	-072	-021	312	207	173	-009	-078	-085
C215	161	153	220	071	232	-016	036	034	062
C217	097	021	079	275	167	038	113	-038	007
C218	316	-047	080	117	226	276	-029	-030	-120
C221	108	097	119	161	196	177	046	078	-032
C223	079	-047	080	188	226	058	-029	020	-063
C301	281	056	083	-002	036	010	-058	-024	087
C302	139	-047	-052	046	092	058	-120	220	051
C303	085	-024	-148	058	-082	015	-093	153	047
C304	215	197	-011	147	157	224	004	010	-136
C305	333	223	040	312	162	107	-035	-016	-123
C306	132	198	165	085	091	-050	028	114	037
C307	198	185	119	228	193	184	-069	-057	-139
C308	286	038	092	145	268	165	-035	023	-033
C309	293	186	030	245	300	270	-070	-080	-359
C313	-184	-136	-079	016	-070	-108	-047	245	276
C314	095	-070	004	-019	-043	-133	091	205	010
C701	034	205	-109	130	174	144	071	-062	-167
C702	-083	-038	-148	-058	-078	-048	031	-099	-161
C726	023	017	-029	088	165	098	-079	-007	085
C728	138	130	-053	144	038	065	026	071	-030
C729	-086	-165	-136	-034	-132	065	026	-055	-101
C801	451	253	147	263	320	177	009	-051	-127
C802	321	118	122	236	280	252	-107	085	-085
C803	-030	-046	-018	041	099	010	-033	020	-118

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E5

Correlations Among Package 01 Competencies

COMPETENCY	COMPETENCY										
	C801	C802	C803	C804	C805	C806	C807	C808	C810	C811	C812
C804				(638)	214	050	246	187	079	201	147
C805					(766)	341	146	489	240	135	480
C806						(655)	110	165	-017	036	203
C807							(801)	341	264	397	056
C808								(765)	356	265	270
C810									(668)	181	465
C811										(822)	090
C812											(837)
C813											
C814											
C815											
C816											
C817											
C819											
C821											
C822											
C823											
C824											
C825											
C826											
C827											
C828											
C830											
C831											
C832											
C834											
C911											
C912											

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E5

Correlations Among Package 01 Competencies

COMPE- TENCY	COMPETENCY										
	C813	C814	C815	C816	C817	C819	C821	C822	C823	C824	C825
C804	148	061	144	102	064	031	277	235	124	107	-096
C805	267	221	075	154	387	139	387	282	139	-020	011
C806	257	291	036	175	074	235	215	243	-040	156	140
C807	247	197	336	231	302	212	265	271	-037	197	021
C808	327	233	386	278	345	151	286	341	200	136	181
C810	235	161	251	148	246	345	330	247	002	049	-020
C811	109	007	431	466	207	214	295	391	148	203	128
C812	222	250	090	164	232	422	358	301	017	-069	062
C813	(813)	726	297	253	102	289	137	171	033	222	203
C814		(806)	137	289	134	173	108	174	066	159	228
C815			(882)	082	280	280	295	218	-052	333	128
C816				(813)	243	240	136	227	052	043	214
C817					(760)	205	188	081	-034	-160	-009
C819						(782)	304	191	-139	-040	146
C821							(696)	465	039	195	165
C822								(725)	238	360	228
C823									(626)	066	-035
C824										(686)	317
C825											(744)
C826											
C827											
C828											
C830											
C831											
C832											
C834											
C911											
C912											

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E5

Correlations Among Package 01 Competencies

COMPETENCY	COMPETENCY								
	C826	C827	C828	C830	C831	C832	C834	C911	C912
C804	136	-013	-103	048	013	177	-060	025	003
C805	062	189	206	154	225	174	-030	039	024
C806	080	137	212	254	376	270	-103	-002	-137
C807	472	215	013	231	192	252	056	-010	-140
C808	409	107	111	106	345	242	-098	095	081
C810	371	247	291	016	183	028	038	105	-044
C811	256	245	194	236	280	173	090	-023	038
C812	240	462	394	164	232	272	036	-033	-088
C813	356	095	032	312	440	213	-083	-062	-120
C814	353	083	004	351	486	311	-148	-101	-189
C815	514	118	122	236	207	173	-009	-023	-023
C816	216	145	228	493	519	144	164	-062	-050
C817	123	112	261	105	211	-023	054	147	-075
C819	265	407	364	177	265	195	179	003	-078
C821	304	198	117	085	237	213	-103	-031	-004
C822	478	187	217	227	289	306	-120	-061	-107
C823	-050	-112	-103	-011	085	-063	-144	225	225
C824	405	032	119	228	251	247	-148	-057	-039
C825	395	211	083	319	491	442	-074	-202	-058
C826	(850)	271	221	338	470	423	-074	-202	-198
C827		(704)	488	145	226	224	230	-216	-158
C828			(713)	228	325	177	133	-066	-032
C830				(779)	519	442	-023	-165	-226
C831					(802)	403	054	-146	-186
C832						(778)	-112	-201	-217
C834							(538)	-099	-013
C911								(676)	502
C912									(659)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E6

Correlations Among Package 02 Competencies

COMPETENCY	COMPETENCY C101	C102	C103	C104	C105	C106	C107	C108	C109	C110	C111	C112
C101	(631)	057	-019	-020	-022	-137	096	-020	024	-111	001	017
C102		(778)	125	-086	231	243	057	168	269	306	051	165
C103			(730)	228	167	155	168	150	188	094	240	116
C104				(722)	065	-057	125	082	159	122	091	098
C105					(773)	367	099	197	119	265	214	-020
C106						(768)	165	363	130	390	131	-010
C107							(727)	236	230	322	306	085
C108								(760)	156	274	130	098
C109									(751)	184	258	000
C110										(820)	177	209
C111											(738)	039
C112												(774)
C113												
C114												
C115												
C116												
C118												
C119												
C401												
C402												
C403												
C405												
C406												
C407												
C408												
C409												
C413												
C414												
C415												
C416												
C417												
C418												
C420												
C421												
C603												
C604												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E6

Correlations Among Package 02 Competencies

COMPE-TENCY	C113	C114	C115	C116	C118	C119	C401	C402	C403	C405	C406	C407
C101	061	051	-105	-076	-004	-082	033	-062	-076	168	-006	185
C102	294	213	318	198	187	322	018	094	025	058	-061	161
C103	096	-052	043	166	-081	104	-076	-065	084	105	065	156
C104	268	-007	-165	-023	-020	-040	-032	-020	073	109	-030	014
C105	241	055	219	209	219	239	-071	108	049	-063	-122	013
C106	194	115	286	293	165	170	-124	119	-026	-115	-160	026
C107	151	226	096	190	-004	-082	-108	004	190	-069	-082	062
C108	160	306	108	270	236	149	-187	070	101	-137	017	-144
C109	162	263	299	050	161	195	-132	-022	141	013	-016	-132
C110	121	207	322	322	013	273	-088	177	240	-088	-120	020
C111	101	152	230	295	077	163	-123	-132	-009	101	058	298
C112	-031	-045	-119	-135	-051	105	119	146	225	070	025	186
C113	(773)	330	-030	272	151	240	009	-044	033	062	-112	-004
C114		(756)	138	258	138	334	-163	-117	026	-125	-055	030
C115			(800)	323	297	289	-108	071	057	-069	-082	-121
C116				(851)	057	268	-155	-053	-055	-107	-113	-014
C118					(665)	042	033	137	-076	-069	069	-060
C119						(715)	-037	-153	-059	-067	-030	-040
C401							(699)	138	126	190	207	147
C402								(732)	211	142	-044	031
C403									(780)	050	-014	-014
C405										(769)	207	342
C406											(752)	185
C407												(735)
C408												
C409												
C413												
C414												
C415												
C416												
C417												
C418												
C420												
C421												
C603												
C604												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E6

Correlations Among Package 02 Competencies

COMPE-TENCY	COMPETENCY C408	C409	C413	C414	C415	C416	C417	C418	C420	C421	C603	C604
C101	161	101	309	083	215	-030	110	-030	083	018	-013	051
C102	046	-089	-121	100	-126	001	-058	001	-026	265	037	270
C103	-025	048	-040	-058	024	-016	-302	040	182	298	002	166
C104	-039	175	122	-104	-005	203	-157	072	106	110	246	-007
C105	-004	-035	-029	-102	065	024	-061	078	014	148	072	318
C106	-077	-010	-145	078	-055	-023	-055	085	-096	273	-096	062
C107	092	038	-178	-110	005	-030	-099	-030	083	254	-013	-037
C108	-019	-021	-051	085	-135	045	-202	102	085	109	085	027
C109	200	050	-072	007	-030	162	114	100	007	263	007	083
C110	-028	-035	-099	051	-158	-102	-094	065	-008	229	111	153
C111	153	090	-047	134	094	-037	-065	101	-013	185	-013	086
C112	047	106	106	-131	-106	-031	-106	-092	261	080	000	074
C113	100	033	-079	-126	075	269	-020	106	135	093	-039	094
C114	203	105	-091	038	065	094	-027	015	038	012	-047	005
C115	024	-025	-039	083	-099	061	110	151	-110	254	-013	314
C116	050	-086	-129	-079	-072	-087	-072	033	-079	069	-079	142
C118	161	-088	-039	180	005	061	110	151	-110	077	083	-037
C119	026	023	-054	-086	-078	128	051	017	033	027	-086	226
C401	158	109	100	-021	091	009	165	009	115	101	047	022
C402	024	006	-010	-013	-116	-104	023	015	-077	155	115	058
C403	050	080	056	-079	-072	152	067	152	048	070	048	142
C405	216	085	282	130	086	008	148	168	-098	187	073	031
C406	292	197	150	-092	-070	091	243	023	-092	-105	052	-055
C407	120	105	010	-020	024	-059	024	051	-138	082	039	137
C408	(718)	050	214	-059	042	038	186	-023	-059	142	139	-037
C409		(686)	254	-185	084	259	214	089	116	-086	-004	105
C413			(732)	014	122	109	267	109	-120	001	-053	-030
C414				(757)	198	-039	097	048	-022	158	071	-047
C415					(741)	075	125	169	-104	-011	-104	065
C416						(831)	169	106	048	-066	048	015
C417							(778)	169	-104	-072	-104	-027
C418								(724)	-039	040	-126	094
C420									(827)	-068	-115	-047
C421										(645)	158	167
C603											(633)	207
C604												(787)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E6

Correlations Among Package 02 Competencies

COMPE-TENCY	COMPETENCY C605	C606	C607	C608	C609	C610	C611	C613	C614	C615	C616	C617
C101	076	-062	037	-056	-037	-026	086	013	115	-004	-044	051
C102	148	051	-051	128	042	114	016	306	056	-085	080	042
C103	061	141	122	058	002	044	083	209	057	056	020	166
C104	206	172	163	128	120	117	161	167	045	161	104	057
C105	175	028	-049	148	-050	142	097	228	097	235	033	265
C106	-082	-001	-190	025	010	193	-176	241	-007	113	-011	-043
C107	076	-062	037	-056	-037	-090	-069	075	-079	055	041	-125
C108	-047	070	-197	155	-085	006	-101	195	031	215	118	-029
C109	178	115	-117	-151	023	188	-151	184	-098	103	066	023
C110	-154	054	-055	219	-009	258	-139	199	-029	070	078	-009
C111	010	020	-122	-056	-048	120	-037	083	-057	-026	072	-048
C112	-123	-124	-215	031	134	000	-105	084	022	-040	231	-104
C113	052	075	-020	010	015	095	041	232	052	068	236	094
C114	045	-001	-092	-023	-072	019	-108	045	-022	037	069	-072
C115	076	203	-090	066	-125	228	-070	260	-014	-004	-044	-037
C116	-050	123	096	099	-090	012	-004	240	-065	132	019	026
C118	076	004	-090	005	-037	101	-070	137	050	055	-044	226
C119	-054	011	-092	-030	-098	143	-020	197	-004	-063	004	010
C401	114	-096	003	101	022	048	026	042	255	-110	-025	-039
C402	160	-189	-110	-021	058	-068	-173	013	039	035	-016	174
C403	-050	035	-157	018	026	-073	-107	158	-065	-024	132	-090
C405	017	142	-044	-033	031	181	-010	095	036	-030	052	134
C406	-103	006	008	-130	-121	151	-104	019	-022	-050	-066	-055
C407	-072	-171	-040	-016	-023	-040	-059	-018	-012	-078	-041	-130
C408	079	-022	-030	-068	-037	144	-151	-028	035	-018	125	-037
C409	058	131	071	-041	050	071	075	043	127	036	013	-005
C413	-016	128	-017	085	-030	160	-035	-013	004	045	016	-091
C414	-072	051	017	026	038	078	070	-068	030	079	-054	038
C415	-065	-116	060	-082	-118	-007	022	-029	072	092	-034	065
C416	052	135	-020	-154	-064	152	251	121	-006	-039	-071	015
C417	-065	023	-140	-209	-027	060	-140	-094	072	-155	-123	-118
C418	-079	-044	-191	010	015	037	-169	177	052	174	005	015
C420	067	051	-044	-032	207	017	220	-008	217	-035	110	122
C421	035	155	-023	080	115	126	-016	120	205	240	036	012
C603	067	051	139	202	038	139	295	051	092	135	110	207
C604	045	116	130	189	-149	019	300	261	-022	192	-005	158

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TABLE E6

Correlations Among Package 02 Competencies

COMPE-TENCY	COMPETENCY											
	C620	C622	C625	C626	C627	C628	C629	C630	C902	C903	C904	C905
C101	-026	-129	203	115	061	013	-134	-004	044	057	-027	052
C102	031	025	051	-099	001	-015	009	122	047	-061	134	139
C103	044	126	017	037	096	248	192	168	005	084	240	262
C104	117	043	269	-031	137	032	089	053	292	073	250	127
C105	-049	136	-012	013	024	153	113	159	186	-110	175	-015
C106	001	143	039	070	-023	055	170	-016	056	-106	-073	037
C107	-026	127	004	-051	061	199	199	096	-077	057	117	-184
C108	006	282	155	-007	102	195	046	-085	-022	-069	021	-011
C109	014	300	024	051	038	-028	051	161	006	050	194	160
C110	062	131	095	058	-046	122	161	013	092	-006	017	-059
C111	-025	137	020	058	101	224	185	153	039	193	135	010
C112	172	000	056	-127	-031	000	099	017	072	045	036	060
C113	-020	005	135	-004	188	177	221	061	085	033	321	-080
C114	-092	144	116	058	094	-009	131	051	010	026	048	-051
C115	037	212	-129	115	061	-049	282	-105	-016	-076	117	-007
C116	-073	019	035	123	152	240	233	057	-026	-055	-028	-140
C118	-090	297	-129	115	-030	013	115	-105	105	-076	117	052
C119	-013	109	011	-003	017	121	-003	042	021	104	131	054
C401	003	-085	044	-070	072	-002	-070	033	046	-061	081	-037
C402	016	-016	-101	025	-044	-110	025	-062	119	123	-080	-017
C403	012	019	-053	013	-087	-088	013	-076	134	297	162	094
C405	144	-099	142	023	168	-052	-075	-069	-008	050	126	200
C406	056	-130	006	048	023	-073	-014	-157	-069	086	-040	210
C407	-001	-145	-009	-109	-004	-018	-160	001	173	148	-090	052
C408	144	066	-068	051	100	057	-006	-114	047	141	047	-042
C409	031	-094	048	-022	089	-035	-074	-025	103	163	098	-048
C413	027	-161	-010	118	046	-142	-055	-039	106	056	009	222
C414	078	110	243	099	-039	051	-061	083	020	-079	166	023
C415	-007	-034	092	133	-020	-029	-127	005	134	-072	-012	021
C416	-134	005	-044	071	025	065	-079	061	031	152	321	-080
C417	-073	-034	-116	-040	-114	-223	-127	-099	-055	067	-086	-040
C418	-077	236	-044	-004	025	010	071	061	085	033	128	-027
C420	-044	110	179	-061	048	051	019	373	-096	-079	166	-033
C421	163	186	116	010	199	084	205	018	096	-008	171	106
C603	200	-054	243	099	135	-008	-141	-110	020	176	028	023
C604	019	-005	058	-087	094	-063	-014	-037	010	142	048	001

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TABLE E6

Correlations Among Package 02 Competencies

COMPE- TENCY	COMPETENCY C906	C910	C911	C912	C915	C917	C001	C002	C003	C004	C009	C010
C101	057	-082	165	230	061	-079	-058	068	300	171	-165	-018
C102	025	-080	-031	-088	-116	056	-074	013	-123	019	150	079
C103	001	104	-033	060	-016	218	043	106	-049	105	273	176
C104	-023	-040	074	060	072	092	-001	068	-011	083	002	188
C105	-189	017	-139	-169	-192	-096	-070	-046	-111	-016	108	099
C106	-026	021	-089	-201	-132	-163	-087	-071	-138	-148	205	010
C107	190	042	044	161	061	-014	-117	007	-020	-010	125	158
C108	016	-008	016	-020	-071	072	075	-054	-023	-127	128	154
C109	050	-058	-077	-036	-023	-009	-211	-122	-107	057	209	100
C110	076	-032	-019	-155	-102	-029	046	-043	-082	-156	167	243
C111	-110	-025	-007	101	032	140	027	214	-114	186	257	083
C112	135	-146	112	140	-031	153	010	115	054	000	049	199
C113	-087	128	031	-023	-056	168	-085	114	102	147	007	225
C114	026	118	062	083	015	091	-059	-016	138	122	057	039
C115	-076	-082	-016	-045	-120	-144	-176	-055	-149	050	271	099
C116	121	104	-106	-041	-087	192	-020	072	-069	058	361	164
C118	-076	-082	165	-045	-120	-144	-058	007	-085	-010	125	-077
C119	-059	088	-202	-143	-094	155	-058	191	-088	100	139	045
C401	126	049	089	062	072	028	005	311	173	-006	-134	-019
C402	-141	011	159	-022	-044	-132	046	-202	027	-151	-020	-116
C403	121	104	054	050	152	021	-098	-010	186	-102	073	086
C405	-028	-067	206	175	062	-002	094	001	015	191	-234	-048
C406	-014	154	066	087	-044	-022	091	194	-174	211	024	-115
C407	-176	-040	210	162	106	067	079	193	-065	224	014	-010
C408	-041	026	088	106	038	124	073	215	068	223	010	060
C409	-003	023	254	179	089	127	024	209	179	356	039	233
C413	056	032	273	118	046	-086	096	062	171	158	-080	203
C414	176	-086	-038	-125	-039	-094	084	-074	085	-149	036	-102
C415	067	051	134	257	-020	005	-212	-034	200	203	-081	011
C416	-087	128	085	038	025	168	-032	114	160	201	-124	172
C417	067	180	134	042	169	005	-150	-034	066	076	-005	-112
C418	033	128	194	100	106	-122	-191	-052	-013	038	137	-040
C420	176	033	020	073	135	154	084	104	270	-091	-034	182
C421	070	027	-045	-019	146	-022	084	101	-041	009	195	070
C603	-079	-086	-038	007	-039	030	084	104	-038	026	036	-045
C604	-090	010	-043	023	-143	034	-059	038	-197	069	120	090

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E6

Correlations Among Package 02 Competencies

COMPE-TENCY	COMPETENCY C011	C012	C013	C014	C015	C017	C018	C019
C101	095	-068	072	077	061	-051	031	-004
C102	134	252	079	036	080	121	150	187
C103	-129	-010	079	043	263	158	047	106
C104	-169	-125	021	068	127	000	021	053
C105	-073	052	-065	148	142	020	012	159
C106	-066	023	-002	-116	091	-051	-020	044
C107	-064	064	-115	018	179	017	-178	-105
C108	-088	-028	-055	-041	113	011	-095	-020
C109	131	103	-009	-060	113	047	-072	024
C110	-076	080	-143	048	046	042	073	075
C111	094	161	188	141	251	039	-100	001
C112	-148	000	-016	000	050	-011	200	085
C113	-021	008	-048	040	180	153	109	061
C114	177	050	026	115	147	074	-030	051
C115	175	261	-022	-099	-058	-051	-039	-105
C116	002	291	040	226	214	045	-129	057
C118	095	261	-022	-099	-058	-051	100	-004
C119	-112	168	140	-045	087	105	117	165
C401	014	054	125	019	-119	024	051	033
C402	-057	-111	032	-079	-111	011	082	071
C403	002	-144	040	-008	058	045	148	-076
C405	-124	-114	150	048	094	110	036	050
C406	024	046	107	071	135	076	-058	069
C407	006	057	301	189	151	062	179	062
C408	131	148	183	142	113	326	023	230
C409	160	020	190	208	245	021	080	025
C413	087	-066	192	206	096	012	083	100
C414	079	107	059	-182	-086	-196	-053	-110
C415	113	017	-012	174	097	-106	-024	005
C416	051	067	120	-066	021	-031	-016	-030
C417	030	085	183	-134	097	-035	-024	-099
C418	-164	-051	036	-066	-032	031	046	-120
C420	079	-146	-121	-068	027	000	081	-110
C421	-085	095	124	068	187	159	042	018
C603	003	044	-031	045	141	131	014	083
C604	-032	107	-055	012	044	136	092	138

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E6

Correlations Among Package 02 Competencies

COMPETENCY	COMPETENCY											
	C605	C606	C607	C608	C609	C610	C611	C613	C614	C615	C616	C617
C605	(821)	160	225	075	-082	133	128	293	050	021	-085	171
C606		(742)	142	302	116	395	240	300	125	113	097	174
C607			(685)	206	-092	074	335	101	018	193	-106	241
C608				(707)	030	206	256	144	259	170	152	189
C609					(731)	130	232	207	316	037	218	081
C610						(839)	138	258	264	193	110	241
C611							(865)	101	157	090	016	368
C613								(751)	131	253	078	153
C614									(785)	238	292	203
C615										(782)	159	192
C616											(627)	069
C617												(792)
C620												
C622												
C625												
C626												
C627												
C628												
C629												
C630												
C902												
C903												
C904												
C905												
C906												
C910												
C911												
C912												
C915												
C917												
C001												
C002												
C003												
C004												
C009												
C010												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E6

Correlations Among Package 02 Competencies

	COMPETENCY											
COMPETENCY	C620	C622	C625	C626	C627	C628	C629	C630	C902	C903	C904	C905
C605	-051	038	064	-088	-079	025	152	221	005	-050	095	-113
C606	227	267	252	080	314	095	246	004	119	-053	299	139
C607	-047	002	058	-015	-020	101	091	101	001	012	102	-028
C608	167	100	181	015	230	144	066	005	171	-143	012	180
C609	186	069	116	-087	094	-009	131	138	168	-090	110	001
C610	235	272	227	196	152	023	249	-154	154	-073	011	196
C611	-010	016	240	134	181	053	069	086	-082	-004	094	-014
C613	062	131	136	007	121	084	212	137	204	-088	193	014
C614	223	127	210	001	168	-029	108	-014	265	-065	031	082
C615	193	159	270	128	281	034	177	-004	220	-103	220	007
C616	272	058	097	046	159	131	117	-044	092	132	094	078
C617	-147	218	174	-014	015	045	058	-037	-043	026	110	155
C620	(756)	110	227	091	381	062	038	154	040	012	192	046
C622		(870)	041	-024	-071	183	258	-044	195	-093	155	028
C625			(761)	080	314	054	080	004	039	035	062	139
C626				(644)	221	007	035	-051	020	013	079	200
C627					(813)	121	221	061	031	033	256	132
C628						(675)	161	137	-019	-088	237	-168
C629							(846)	-051	020	-097	198	-045
C630								(765)	105	057	188	-066
C902									(739)	054	056	073
C903										(728)	067	094
C904											(815)	-027
C905												(806)
C906												
C910												
C911												
C912												
C915												
C917												
C001												
C002												
C003												
C004												
C009												
C010												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E6

Correlations Among Package 02 Competencies

COMPE-TENCY	COMPETENCY C906	C910	C911	C912	C915	C917	C001	C002	C003	C004	C009	C010
C605	-050	124	005	079	052	050	-146	-157	-047	009	-108	-035
C606	035	011	-001	024	075	082	046	083	070	210	-068	352
C607	096	065	001	057	-077	100	092	050	087	244	-159	098
C608	018	-105	-085	-068	010	063	263	082	038	-025	-049	349
C609	142	-098	-043	083	094	-079	096	038	194	-037	-133	142
C610	-073	-013	-037	-030	095	-023	092	011	046	205	-021	284
C611	099	-020	-036	009	-099	107	144	140	147	067	-120	198
C613	158	-032	018	184	-046	-109	-208	-005	-121	180	032	061
C614	106	075	-046	035	285	043	172	118	237	043	-095	060
C615	132	083	113	103	068	-067	113	-059	-012	133	118	073
C616	019	-101	041	125	005	127	-035	018	118	099	-143	214
C617	026	118	-096	-037	-064	091	096	-070	027	069	-070	039
C620	012	-170	040	057	037	059	054	089	006	013	-067	172
C622	019	-101	-062	066	312	-038	016	-139	064	-004	104	164
C625	299	-153	-081	069	075	-004	046	124	197	090	-020	079
C626	-097	-105	070	051	-079	-053	038	000	152	078	089	-010
C627	-087	017	085	100	106	168	074	335	160	256	072	278
C628	-088	-032	055	057	-046	290	192	184	076	143	-012	170
C629	013	202	070	165	071	-052	-011	000	046	128	089	234
C630	190	042	-016	-045	-030	115	-117	068	108	-010	053	041
C902	-106	021	092	047	248	-046	091	041	170	180	117	045
C903	-055	104	054	141	152	277	-020	234	101	138	-023	-070
C904	067	043	-030	-051	-001	077	018	226	021	152	-061	249
C905	-062	-019	-069	-082	132	-031	023	-003	-049	-088	121	-002
C906	(730)	-059	-026	050	033	-065	-098	072	101	-183	073	008
C910		(783)	021	-058	240	234	014	040	-088	-049	049	-100
C911			(784)	502	-078	148	-016	-071	248	216	030	116
C912				(754)	162	035	-130	047	244	389	-089	100
C915					(818)	052	074	114	160	038	007	013
C917						(719)	210	237	154	160	045	250
C001							(793)	244	075	004	-087	090
C002								(691)	182	202	112	188
C003									(708)	183	-104	229
C004										(820)	-005	205
C009											(730)	103
C010												(780)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E6

Correlations Among Package 02 Competencies

COMPE- TENCY	COMPETENCY							
	C011	C012	C013	C014	C015	C017	C018	C019
C605	021	-036	-075	-050	-061	-025	-117	076
C606	049	020	032	116	-033	056	036	004
C607	056	128	-120	126	-021	043	-017	-026
C608	-046	-006	-010	152	-059	113	085	066
C609	038	050	107	012	096	074	335	-037
C610	156	003	-002	163	017	043	160	164
C611	106	025	055	-016	006	000	019	008
C613	022	120	-028	-025	119	-084	158	013
C614	-131	196	071	167	058	022	228	-079
C615	-116	013	-064	066	182	-080	045	-063
C616	-042	-079	-142	136	116	000	135	-044
C617	-032	-008	137	064	044	015	-030	226
C620	-045	086	175	089	092	086	204	101
C622	026	033	-142	036	-135	000	075	041
C625	-109	-111	032	038	085	-034	-148	137
C626	146	017	085	059	086	042	002	032
C627	-021	067	288	093	127	031	046	-120
C628	-125	-001	087	120	083	042	-013	013
C629	-118	126	-147	-087	-011	-183	002	-051
C630	016	064	072	018	002	017	031	-004
C902	-066	063	222	309	-051	-092	231	105
C903	-103	-057	287	070	136	225	-037	057
C904	-062	052	080	-123	102	036	108	-098
C905	-086	004	052	141	-011	100	099	170
C906	002	030	-083	-086	058	-135	-037	057
C910	-112	087	140	027	087	105	-140	165
C911	173	102	166	132	091	-010	106	-016
C912	077	-033	055	182	194	-093	071	024
C915	-092	-110	120	199	127	-031	172	-120
C917	-080	153	312	167	172	284	-086	179
C001	-062	024	216	153	270	130	178	061
C002	-035	109	366	065	208	115	105	068
C003	115	-070	124	146	037	011	038	-149
C004	038	114	285	400	218	082	074	-010
C009	061	209	156	153	212	049	-080	125
C010	132	021	-015	243	193	120	121	099

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E6

Correlations Among Package 02 Competencies

COMPETENCY	C011	C012	C013	C014	C015	C017	C018	C019
C011	(760)	092	-010	148	172	013	032	-064
C012		(726)	148	133	101	089	071	129
C013			(807)	179	161	110	063	258
C014				(769)	222	239	083	254
C015					(789)	170	014	002
C017						(641)	012	289
C018							(671)	-039
C019								(843)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

	COMPETENCY											
COMPETENCY	C310	C312	C361	C363	C364	C366	C368	C371	C372	C373	C374	C375
C310	(770)	360	021	016	-086	152	069	-101	-054	062	-032	088
C312		(852)	236	072	019	019	137	-010	277	048	160	074
C361			(813)	250	261	065	039	000	171	279	293	188
C363				(843)	058	187	131	049	262	197	566	181
C364					(804)	-022	061	-054	067	219	111	-086
C366						(811)	134	275	067	113	111	271
C368							(740)	202	231	031	130	-025
C371								(854)	038	-023	025	004
C372									(843)	097	203	124
C373										(813)	264	332
C374											(826)	-032
C375												(815)
C376												
C378												
C401												
C402												
C404												
C405												
C406												
C407												
C408												
C409												
C411												
C412												
C413												
C414												
C415												
C418												
C421												
C501												
C502												
C506												
C507												
C508												
C541												
C542												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPETENCY	COMPETENCY											
	C376	C378	C401	C402	C404	C405	C406	C407	C408	C409	C411	C412
C310	188	088	049	256	-094	006	062	035	026	100	-136	062
C312	314	-069	146	066	-101	104	129	149	085	045	017	048
C361	218	105	263	281	092	110	127	062	-047	021	215	056
C363	341	016	223	311	144	087	016	210	-011	-007	296	123
C364	-065	-086	183	115	-126	-041	052	039	-059	-185	021	-099
C366	392	-086	-021	115	-039	-041	052	-138	-125	116	-047	007
C368	142	163	038	070	-037	056	001	018	-056	-006	230	031
C371	173	004	035	-016	236	102	125	-041	-050	066	-035	071
C372	172	-054	114	064	182	102	222	105	277	058	293	097
C373	130	-074	156	262	-009	062	-058	050	-013	-004	153	398
C374	168	-032	085	218	010	021	065	057	-028	-035	262	061
C375	272	-064	136	338	017	224	-030	-040	-058	023	037	062
C376	(840)	105	215	326	031	030	076	-021	-047	148	072	-019
C378		(729)	136	-071	-094	006	-123	-040	026	-054	037	-074
C401			(775)	138	199	190	207	147	158	109	041	156
C402				(837)	015	142	-044	031	024	006	143	116
C404					(678)	168	293	216	038	259	118	288
C405						(793)	207	342	216	085	101	192
C406							(837)	185	292	197	267	188
C407								(732)	120	105	197	184
C408									(710)	050	083	-013
C409										(699)	023	202
C411											(822)	308
C412												(818)
C413												
C414												
C415												
C418												
C421												
C501												
C502												
C506												
C507												
C508												
C541												
C542												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPETENCY	COMPETENCY											
	C413	C414	C415	C418	C421	C501	C502	C506	C507	C508	C541	C542
C310	-054	-086	-078	017	172	-090	004	-059	-090	-064	075	-098
C312	-069	131	-084	004	127	119	-010	090	011	074	124	098
C361	-035	131	035	214	000	110	231	-045	-016	-063	197	074
C363	-046	-071	-111	023	098	040	163	040	165	098	398	066
C364	-187	071	-104	-039	102	-031	028	048	-031	033	092	291
C366	081	-115	-003	048	102	238	110	176	238	152	279	122
C368	-047	-013	-065	032	051	401	137	-110	-025	163	189	152
C371	016	-054	-034	-148	-314	333	420	245	-063	-101	182	218
C372	-016	-072	-065	-079	035	194	161	142	328	124	330	298
C373	-083	-099	026	-009	022	101	164	-068	-103	062	167	176
C374	-099	-008	-094	-102	-025	145	131	-006	030	045	330	153
C375	032	-086	-078	128	100	025	004	-059	-090	-064	075	118
C376	012	065	035	-031	199	174	173	045	047	105	372	193
C378	032	033	051	240	172	025	-101	-059	-090	088	075	-098
C401	100	-021	091	009	101	-071	155	-155	-071	136	119	084
C402	-010	-013	-116	015	155	094	210	-141	-153	-153	253	-001
C404	172	-039	169	025	-119	036	159	152	036	017	052	-064
C405	282	130	086	168	187	-071	102	-028	039	152	074	031
C406	150	-092	-070	023	-105	037	062	-014	037	154	075	076
C407	010	-020	024	051	082	074	011	-095	017	186	027	-077
C408	214	-059	042	-023	142	-073	-050	050	055	026	079	263
C409	254	-185	084	089	-086	073	119	-003	132	100	046	-169
C411	095	-115	056	055	-101	137	-035	-032	071	124	108	039
C412	069	-099	026	090	022	-001	071	078	101	197	096	-016
C413	(769)	014	122	109	001	128	-161	-037	063	032	-041	-091
C414		(818)	198	048	158	-031	-054	-079	-031	-086	-032	122
C415			(787)	169	-011	-012	-034	-072	-012	051	-063	-118
C418				(755)	040	-048	-148	033	036	128	-006	-143
C421					(774)	-094	-114	-008	070	172	054	115
C501						(849)	413	164	134	254	131	026
C502							(841)	132	096	109	127	-005
C506								(794)	411	104	106	142
C507									(825)	369	192	026
C508										(803)	075	010
C541											(818)	260
C542												(750)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPE-TENCY	COMPETENCY C543	C545	C547	C603	C604	C606	C608	C610	C611	C613	C614	C615
C310	-018	-045	-086	271	226	092	-030	143	172	197	-084	083
C312	033	073	-093	578	402	-011	209	038	236	089	049	109
C361	203	093	000	131	074	-214	-010	-043	-105	-084	-022	080
C363	356	240	-136	-007	-052	-179	086	-098	-061	027	139	018
C364	132	150	-022	-022	038	-205	-091	-167	-080	051	-032	-206
C366	071	150	-022	-022	122	-077	085	017	070	-127	030	135
C368	255	103	-013	061	152	-031	083	120	-037	083	140	199
C371	-006	314	110	-054	-080	-016	100	056	082	-132	127	-042
C372	310	101	067	207	045	-128	075	041	016	-065	330	021
C373	-060	111	-099	113	-016	-102	022	-055	-133	-075	026	002
C374	321	194	-008	-008	-009	-192	-082	-212	-091	-030	-069	-148
C375	137	030	-086	033	118	011	195	065	-116	121	-004	156
C376	246	258	000	196	074	-034	113	043	053	000	197	080
C378	215	105	152	-086	010	174	120	065	-116	273	155	083
C401	102	156	047	047	022	-096	101	048	026	042	255	-110
C402	214	021	-013	115	058	-189	-021	-068	-173	013	039	035
C404	-026	044	-039	-126	-143	-044	-099	095	041	-102	052	-039
C405	010	033	073	073	031	142	-033	181	-010	095	036	-030
C406	-048	038	-164	052	-055	006	-130	151	-104	019	-022	-050
C407	023	127	-079	039	137	-171	-016	-040	-059	-018	-012	-078
C408	089	-016	139	139	-037	-022	-068	144	-151	-028	035	-018
C409	044	-035	116	-004	105	131	-041	071	075	043	127	036
C411	342	144	-115	021	101	-091	156	-003	-136	132	108	-014
C412	-060	-022	-099	113	-016	043	-044	014	-047	061	167	002
C413	-027	-043	081	-053	-030	128	085	160	-035	-013	004	045
C414	-050	-026	-115	071	-047	051	026	078	070	-068	030	079
C415	-078	082	097	-104	065	-116	-082	-007	022	-029	072	092
C418	030	044	048	-126	094	-044	010	037	-169	177	052	174
C421	032	027	-012	158	167	155	080	126	-016	120	205	239
C501	226	180	-031	059	026	-153	160	-120	-017	-143	192	210
C502	048	107	028	028	-154	-072	-004	-052	082	-238	237	009
C506	007	063	-079	048	-090	123	099	-073	099	-088	106	-024
C507	167	067	059	059	-055	032	-010	-002	055	-085	131	045
C508	215	180	-086	152	118	011	045	-013	076	121	234	010
C541	372	290	154	092	-079	-004	-133	059	-144	011	168	-029
C542	232	183	038	122	-072	-117	083	-036	-040	-009	091	-066

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPE-TENCY	COMPETENCY C616	C617	C618	C620	C622	C625	C626	C627	C628	C629	C630	C905
C310	004	226	091	-092	109	092	-003	-094	-184	-003	-082	126
C312	-109	199	071	-036	-010	143	-017	004	-126	-113	-088	019
C361	-115	074	-082	-129	-115	-079	042	-092	000	-070	-051	-060
C363	-065	-052	073	072	-122	-001	-189	-038	-221	-133	-124	001
C364	-054	-047	-067	-167	-136	-141	-061	-126	111	099	083	-090
C366	110	038	011	017	-054	051	019	048	-187	019	-110	194
C368	137	086	-016	120	072	273	058	169	036	058	-076	145
C371	058	144	036	056	-088	097	188	082	-080	-095	-129	278
C372	161	045	026	316	-085	064	-088	182	-065	-088	-069	057
C373	071	080	-124	084	-116	043	-029	090	-007	-120	016	-012
C374	-132	-063	-161	-055	-132	-028	-198	-046	-107	-198	-173	-023
C375	214	010	-109	143	-101	092	-003	128	-108	-003	042	126
C376	000	074	137	172	000	236	155	153	-251	-014	-187	180
C378	214	010	091	065	319	092	100	017	-032	202	-082	054
C401	-025	-039	173	003	-085	044	-070	072	-002	-070	033	-037
C402	-016	174	-097	016	-016	-101	025	-044	-110	025	-062	-017
C404	-071	015	207	152	-071	015	071	025	010	-079	-120	079
C405	052	134	140	144	-099	142	023	168	-052	-075	-069	200
C406	-066	-055	096	056	-130	006	048	023	-073	-014	-157	210
C407	-041	-130	272	-001	-145	-009	-109	-004	-018	-160	001	052
C408	125	-037	-075	144	066	-068	051	100	057	-006	-114	-042
C409	013	-005	198	031	-094	048	-022	089	-035	-074	-025	-048
C411	-035	039	-059	086	-035	-044	-164	-009	-172	-164	-174	-004
C412	-023	176	054	084	-116	043	-120	090	-075	-120	-094	-012
C413	016	-091	215	027	-161	-010	118	046	-142	-055	-039	222
C414	-054	038	-067	078	110	243	099	-039	051	-061	083	023
C415	-034	065	123	-007	-034	092	133	-020	-029	-127	005	021
C418	005	015	134	-077	236	-044	-004	025	010	071	061	-027
C421	036	012	-015	163	186	116	010	199	084	205	018	106
C501	096	-055	074	057	-142	156	085	120	-028	007	-115	216
C502	058	069	-033	110	-088	097	117	159	078	046	-044	178
C506	019	142	007	096	019	-053	123	-087	076	013	-076	094
C507	016	-137	150	175	-142	-029	007	036	-028	085	-115	-003
C508	004	-098	191	221	-101	174	-105	128	-032	-003	-082	054
C541	182	-079	-119	182	-093	082	-053	052	-188	001	-144	-031
C542	144	081	-165	075	-005	116	-087	094	099	-087	138	052

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPE-TENCY	C907	C908	C910	C911	C912	C914	C915	C916	C917	C001	C002	C003
C310	-101	202	-064	021	111	-133	-094	-034	-084	-058	-112	-167
C312	-109	080	-069	-077	005	-060	-101	-036	-026	113	083	-031
C361	-058	-127	105	235	093	-061	-153	-076	-022	170	031	098
C363	-065	-133	-067	-026	-103	217	-098	-078	-121	-012	016	041
C364	-054	-141	033	-154	-059	-040	-039	-045	030	141	104	-038
C366	-054	019	033	020	-125	166	-039	172	154	027	-074	023
C368	137	058	-119	-099	-056	189	-105	110	091	027	-113	032
C371	-015	-024	004	-062	-050	034	005	331	072	166	018	064
C372	038	032	-054	005	-021	302	-079	-028	143	195	021	045
C373	164	153	-074	100	-013	083	-107	-038	-096	007	055	160
C374	-080	-044	-108	-094	-113	237	-157	-096	-109	-099	-081	037
C375	109	100	-064	021	-058	043	017	-034	-084	-058	-112	-088
C376	-058	042	-063	072	-047	230	-031	076	-066	010	-010	011
C378	-101	-003	-064	095	111	043	017	-034	-084	-204	-112	149
C401	-025	-070	049	089	062	081	072	071	028	005	311	173
C402	-016	-030	011	159	-022	-032	-044	-080	-132	046	-202	027
C404	159	146	128	140	100	192	025	-049	110	127	058	045
C405	-049	023	-067	206	175	126	062	-150	-002	094	001	015
C406	125	110	154	066	087	014	-044	-064	-022	091	194	-174
C407	-145	-008	-040	210	162	041	106	-100	067	079	193	-065
C408	-109	-063	026	088	106	145	038	-075	124	073	215	068
C409	066	185	023	254	179	277	089	092	127	024	209	179
C411	-035	[illegible]	-049	081	035	020	-072	-071	017	-005	-051	-128
C412	164	244	197	100	213	083	090	-038	238	007	123	020
C413	075	060	032	273	118	059	046	-073	-086	096	062	171
C414	-054	-061	-086	-038	-125	-109	-039	-045	-094	084	-074	085
C415	-034	-040	051	134	257	-012	-020	195	005	-212	-034	200
C418	-071	-154	128	194	100	-065	106	-049	-122	-191	-052	-013
C421	-214	-087	027	-045	-019	087	146	-137	-022	084	101	-041
C501	096	-070	-090	-002	-009	080	036	163	011	161	023	243
C502	058	-095	-101	143	183	155	082	139	072	166	070	336
C506	019	-097	-059	-026	-041	162	-087	-031	021	136	-010	016
C507	016	-070	025	054	055	412	036	-047	071	052	080	064
C508	109	-105	088	-053	-058	219	128	-034	075	014	267	070
C541	-093	-160	-084	-046	035	353	-064	-085	-123	-056	039	113
C542	-080	-014	010	-254	-217	110	-064	-051	034	199	091	-029

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPE-TENCY	COMPETENCY												
	C004	C005	C006	C009	C010	C011	C012	C013	C014	C015	C016	C017	C01
C310	026	-074	118	049	-027	181	-075	-090	027	014	-049	021	03
C312	068	048	-004	029	-127	-120	060	-097	-009	-024	180	157	01
C361	-082	130	-045	000	-159	-094	000	-016	-040	050	072	-011	106
C363	-178	-024	-169	136	-058	-049	-056	102	058	-170	107	023	001
C364	-091	219	-131	-034	-045	-150	044	-121	-182	084	-115	-065	14
C366	-091	-099	-131	176	125	-074	-020	-031	-012	-029	089	065	-05
C368	-045	-053	019	036	128	-148	010	-167	051	-018	-092	-116	-153
C371	-055	-023	-154	-143	014	-109	-191	096	-014	-085	025	000	-04
C372	097	256	-082	-004	-035	-094	249	059	120	024	-012	172	184
C373	-027	036	-016	-069	-022	-128	-035	-001	-107	007	-079	-019	-007
C374	-193	061	-117	122	-193	-076	-083	030	-170	-099	045	-126	-142
C375	-049	-074	-098	-040	-100	-112	-156	-090	-117	-058	124	105	032
C376	-164	-019	-163	000	-040	-094	-045	-016	040	-150	167	126	-082
C378	-049	-074	226	-040	117	083	087	-090	027	014	037	021	-054
C401	-006	079	022	-134	-019	014	054	125	019	-119	-058	024	051
C402	-151	-030	-059	-020	-116	-057	-111	032	-079	-111	-044	011	082
C404	256	-009	094	-059	013	122	008	288	252	074	118	031	046
C405	191	-068	-021	-234	-048	-124	-114	150	048	094	101	110	036
C406	211	-058	-121	024	-115	024	046	107	071	135	109	076	-05
C407	224	050	084	014	-010	006	057	301	189	151	025	062	179
C408	223	138	143	010	060	131	148	183	142	113	083	326	023
C409	356	202	105	039	233	160	020	190	208	245	199	021	080
C411	048	-001	101	-070	019	-070	085	006	023	-047	058	-072	095
C412	238	-084	080	-069	-022	-128	-035	306	087	201	-001	-019	-083
C413	158	-007	092	-080	203	087	-066	192	206	096	193	012	083
C414	-149	007	-131	036	-102	079	107	059	-182	-086	089	-196	-053
C415	203	-089	156	-081	011	113	017	-012	174	097	056	-106	-024
C418	038	-107	094	137	-040	-164	-051	036	-066	-032	118	031	046
C421	009	022	115	195	070	-085	095	124	068	187	064	159	042
C501	060	101	026	-047	094	-157	-097	-040	070	106	-060	047	-131
C502	048	164	-154	-143	-036	-109	-079	175	-014	-035	-095	-115	075
C506	138	078	-090	073	008	-103	030	040	070	-020	061	225	056
C507	060	101	-055	156	-015	-157	148	134	015	052	006	174	128
C508	-049	062	010	-040	045	-112	006	140	-045	160	037	105	032
C541	-074	-045	-248	-048	022	-029	-101	011	-022	-018	063	-022	049
C542	-089	080	-072	-007	-115	-101	107	026	-039	096	039	134	-030

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPE-TENCY	COMPETENCY											
	C543	C545	C547	C603	C604	C606	C608	C610	C611	C613	C614	C615
C543	(854)	356	132	010	067	-079	104	-019	-117	204	128	-015
C545		(711)	150	-026	-030	-141	072	-052	-067	-031	212	-062
C547			(667)	-022	-047	-013	-150	-044	-005	051	-032	-206
C603				(762)	207	051	202	139	295	051	092	135
C604					(713)	116	189	019	300	261	-022	192
C606						(835)	302	395	240	300	125	113
C608							(839)	206	256	144	259	170
C610								(772)	138	258	264	193
C611									(759)	101	157	090
C613										(830)	131	253
C614											(795)	238
C615												(711)
C616												
C617												
C618												
C620												
C622												
C625												
C626												
C627												
C628												
C629												
C630												
C905												
C907												
C908												
C910												
C911												
C912												
C914												
C915												
C916												
C917												
C001												
C002												
C003												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPE-TENCY	COMPETENCY											
	C616	C617	C618	C620	C622	C625	C626	C627	C628	C629	C630	C905
C543	209	067	-038	021	-006	046	-179	030	-068	030	-158	066
C545	055	023	115	102	004	-020	086	099	-069	-217	-127	286
C547	110	-047	011	-044	028	-141	179	135	111	-061	083	023
C603	110	207	011	200	-054	243	099	135	-008	-141	-110	023
C604	-005	158	048	019	-005	058	-087	094	-063	-014	-037	001
C606	097	174	-044	227	267	252	080	314	095	246	004	139
C608	152	189	132	168	100	181	015	230	144	066	005	180
C610	110	241	021	235	272	227	196	152	023	249	-154	196
C611	016	368	120	-010	016	240	134	181	053	069	086	-014
C613	078	153	090	062	131	136	007	121	084	212	137	014
C614	292	203	038	223	127	210	001	168	-029	108	-014	082
C615	159	192	003	193	159	270	128	281	034	177	-004	007
C616	(767)	069	-033	272	058	097	046	159	131	117	-044	078
C617		(762)	-094	-147	218	174	-014	015	045	058	-037	155
C618			(667)	124	-033	-044	092	134	-060	024	-057	077
C620				(775)	110	227	091	381	062	038	-154	046
C622					(834)	041	-024	-071	183	259	-044	028
C625						(723)	080	314	054	080	004	139
C626							(658)	221	007	035	-051	200
C627								(822)	121	221	061	132
C628									(769)	161	137	-168
C629										(757)	-051	-045
C630											(588)	-066
C905												(780)
C907												
C908												
C910												
C911												
C912												
C914												
C915												
C916												
C917												
C001												
C002												
C003												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPE-TENCY	C907	C908	C910	C911	C912	C914	C915	C916	C917	C001	C002	C003
C543	-113	-127	-096	-165	-127	406	-140	-091	-116	-004	036	-047
C545	-100	-167	-120	-171	-141	205	-010	035	-024	095	179	001
C547	-136	019	-086	-038	073	166	048	-045	154	-086	104	208
C603	-054	099	-086	-038	007	-040	-039	-045	030	084	104	-038
C604	-080	058	010	-043	023	-077	-143	146	034	-059	038	-197
C606	097	190	011	-001	024	110	075	-080	082	046	083	070
C608	-159	015	-105	-085	-068	-032	010	-035	063	263	082	038
C610	056	-015	-013	-037	-030	147	095	054	-023	092	011	046
C611	-116	198	-020	-036	009	-073	-099	115	107	144	140	147
C613	131	058	-032	018	184	-027	-046	-096	-109	-208	-005	-121
C614	017	-160	075	-046	035	169	285	206	043	172	118	237
C615	109	030	083	113	103	-033	068	-014	-067	113	-059	-012
C616	-015	046	-101	041	125	155	005	-053	127	-035	018	118
C617	-080	058	118	-096	-037	-077	-064	146	091	096	-070	027
C618	105	159	-009	196	203	065	060	-057	038	106	231	030
C620	164	196	-170	040	057	328	037	-089	059	054	089	006
C622	-160	-095	-101	-062	066	-027	312	-053	-038	016	-139	064
C625	-016	025	-153	-081	069	157	075	070	-004	046	124	197
C626	117	104	-105	070	051	-039	-079	-055	-053	038	000	152
C627	159	221	017	085	100	321	106	-049	168	074	335	160
C628	078	058	-032	055	057	-027	-046	043	290	192	184	076
C629	046	035	202	070	165	079	071	-054	-053	-011	000	046
C630	-044	032	042	-016	-045	-098	-030	-043	115	-117	068	108
C905	028	-045	-019	-069	-082	141	132	142	-031	023	-003	-049
C907	(811)	400	004	041	066	094	-071	139	-093	066	018	009
C908		(785)	-003	070	165	079	-154	-055	162	-060	-051	-113
C910			(730)	021	-058	-133	240	245	234	014	040	-088
C911				(784)	502	056	-078	-105	148	-016	-071	248
C912					(818)	047	162	-075	035	-130	047	244
C914						(846)	063	-069	215	-024	183	158
C915							(779)	154	052	074	114	160
C916								(785)	060	-011	041	057
C917									(816)	210	237	154
C001										(762)	244	075
C002											(739)	182
C003												(721)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPE-TENCY	COMPETENCY C004	C005	C006	C009	C010	C011	C012	C013	C014	C015	C016	C017	C018
C543	-078	078	067	016	-032	-103	-009	-009	-079	-041	120	-011	061
C545	-159	111	-083	049	-063	-195	-114	123	027	-048	058	093	169
C547	143	219	-047	-104	068	003	-083	149	045	-029	089	131	148
C603	026	007	-047	036	-045	003	044	-031	045	141	-047	131	014
C604	069	176	081	120	090	-032	107	-055	012	044	-022	134	092
C606	210	-102	-001	-068	352	049	020	032	116	-032	002	056	036
C608	-025	022	030	-049	349	-046	-006	-010	152	-059	027	113	085
C610	205	-195	075	-021	284	156	003	-002	163	017	086	043	160
C611	067	038	028	-120	198	106	025	055	-016	006	-081	000	019
C613	180	-075	045	032	061	022	120	-028	-025	119	045	-084	158
C614	043	096	034	-095	060	-131	196	071	167	058	017	022	228
C615	133	-127	089	118	073	-116	013	-064	066	182	-014	-080	045
C616	099	-023	069	-143	214	-042	-079	-142	136	116	-095	000	135
C617	069	-016	158	-070	039	-032	-008	-137	064	044	-084	015	-030
C618	254	-035	-023	016	110	003	108	225	223	059	055	-027	102
C620	013	084	-036	-067	172	-045	086	175	089	092	042	086	204
C622	-004	-116	144	104	164	026	033	-142	036	-135	025	000	075
C625	090	-030	058	-020	079	-109	-111	032	038	085	049	-034	-148
C626	078	-029	-014	089	-010	146	017	085	059	086	070	042	002
C627	256	090	094	072	278	-021	067	288	093	127	-072	031	046
C628	143	129	-009	-012	170	-125	-001	087	120	083	-085	042	-013
C629	128	-120	204	089	234	-118	126	-147	-087	-011	-106	-183	002
C630	-010	126	-037	053	041	016	064	072	018	002	038	017	031
C905	-088	-012	-102	121	-002	-086	004	052	141	-011	079	100	099
C907	151	-023	-080	-019	-036	-042	033	016	036	016	025	-173	016
C908	178	-120	131	-091	039	014	072	085	059	-011	070	-070	-171
C910	-049	-074	010	049	-100	-112	087	140	027	087	037	105	-140
C911	216	034	062	030	116	173	102	166	132	091	-089	-010	106
C912	389	062	023	-089	100	077	-033	055	182	194	-013	-093	071
C914	195	161	-077	146	081	-062	099	279	171	060	120	036	009
C915	038	-009	015	007	013	-092	-110	120	199	127	118	-031	172
C916	-104	-038	-051	-068	005	-059	066	-047	128	-144	-071	076	-073
C917	160	167	-079	045	250	-080	153	312	167	172	-028	284	-086
C001	004	137	-059	-087	090	-062	024	216	153	270	-005	130	178
C002	202	257	-016	112	188	-035	109	366	065	208	122	115	105
C003	183	160	027	-104	229	115	-070	124	146	037	142	011	038

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E7

Correlations Among Package 03 Competencies

COMPE-TENCY	C004	C005	C006	C009	C010	C011	C012	C013	C014	C015	C016	C017	C018
C004	(825)	105	122	-005	205	038	114	285	400	218	091	082	074
C005		(745)	-016	011	-022	133	109	203	087	137	153	205	298
C006			(734)	-007	142	107	165	-055	115	250	-084	015	-030
C009				(752)	103	061	209	156	153	212	-019	049	-080
C010					(750)	132	021	-015	243	193	-106	120	121
C011						(688)	092	-010	148	172	-014	013	032
C012							(730)	148	133	101	-054	089	071
C013								(779)	179	161	202	110	063
C014									(773)	222	023	239	083
C015										(819)	-047	170	014
C016											(642)	072	144
C017												(774)	012
C018													(716)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E8

Factor Pattern for Factor Analysis of Package 01 Competencies
(Harris-Kaiser Independent Clusters Oblique Solution)

COMPE-TENCY	FACTOR 1	2	3	4	5	6	7	8
C201	201	318	-175			-201	469	
C202			-119					690
C203		178		-142	151		-249	573
C204	238		314	-123			121	367
C205	700	148	-145	261			144	149
C206		-486	-241	332	-135	-257		129
C207		-263		111		-295		421
C208		-755	145	161	-161			
C209	-164	-167	588	120		-222	-224	
C210			173	159			255	
C211		159		-105	331		488	223
C212		-275		317	147	-333	179	-106
C215	-125			-252	-266	-274	341	200
C217			270			-479	228	-140
C218	217	-198	647	-174		276		
C221			-137		-145	-378	182	230
C223						299	603	141
C301	354		-291		-154		-169	288
C302	507	-168		169	-186		-337	
C303	427	144		160	-154			
C304	137	-126		128		-484		110
C305	396	-117				-372	-144	
C306	236	123				-433		100
C307	-120	-209		-153		-663		-232
C308	152	-215	252		-217	-138		
C309	262	-122	147	-104		-240	-129	129
C313		-105	-230		-463	-250	-260	
C314	307		221				-174	-270
C701		-157		246	170		237	149
C702		191	196	407	207	-284	134	298
C726	-428	-383	113	228	-222	-287	318	
C728	106	291	358	108		-272	249	205

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown.
Leading decimal points are omitted.

TABLE E8

Factor Pattern for Factor Analysis of Package 01 Competencies (Harris-Kaiser Independent Clusters Oblique Solution)

COMPE-TENCY	FACTOR 1	2	3	4	5	6	7	8
C729	-124	160	707		118	-144		
C801	561		-209	-147		-235	-168	187
C802		-547	-138	-274		-218	-101	-379
C803						108		391
C804	282	163	-112		-163		193	235
C805	-319		114	-368	-204		322	389
C806	-192	-443						355
C807	540			122		-304	182	
C808	141	-121	210	-326	-321	168	295	
C810	149		137	-601	-203			
C811	185		-196			-127	706	-303
C812	-110			-725				195
C813		-341	213	-107		124		428
C814		-462	174				-171	361
C815	665	103	316				185	-174
C816		-398	-221			-230	295	-163
C817	115	272		-275	-125	-283	185	
C819				-571	110	-307	-172	
C821	107	-144	-102	-290	-173		149	
C822		-228		-165		178	532	-110
C823	-214			114	-421	160	450	
C824	471	-319		202		521	234	
C825		-539	-115		237	320		
C826	642	-251		-235	150	221		-135
C827			-164	-464	325	-163		
C828			-120	-600	129		134	-116
C830		-536			237	-105	116	-147
C831		-545		-214	135	150	227	
C832		-554			218	102		
C834	-102	322		-113	320	-199	169	
C911					-637			
C912			-141		-572			
Variance of Oblique Factors	4.041	4.429	2.677	3.482	2.454	3.514	3.526	3.040

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown.
Leading decimal points are omitted.

TABLE E9

Factor Pattern for Factor Analysis of Package 02 Competencies (Harris-Kaiser Independent Clusters Oblique Solution)

COMPETENCY	FACTOR 1	2	3	4	5	6
C101	-100	357				
C102	488	-119	102	123	-111	
C103	195	-132		328	211	
C104			252		253	
C105	502	-136				-127
C106	536	-209				207
C107	234		-160		457	229
C108	363	-168			246	167
C109	523	188				103
C110	461	-293	186		119	266
C111	382	116	-134	318		112
C112	-118	-118	324	164	224	448
C113	310	129		144	309	
C114	362	192	-220		211	
C115	707			-194	-181	
C116	500	-131	-262	276	137	-102
C118	454	159		-240	-214	
C119	413		-139	266		
C401	-198	153	217			
C402			268	-140	-180	282
C403			197		188	416
C405		273	341		-260	
C406		222		218	-340	
C407		116		392	-203	260
C408	136	283		280	-200	107
C409		433		190		
C413		404	228		-229	
C414			130	-260		
C415		430		-113		-123
C416		401	-174		132	-188
C417		495		-139	-270	154
C418	257	307		-222		207
C420	-233				583	
C421	329		344			144
C603		-143	278	142	-182	-195
C604	331			153	-176	-186
C605	141	131		-161		-332
C606	187	111	299			-389
C607						-578
C608		-294	435			-269

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown.
Leading decimal points are omitted.

TABLE E9

Factor Pattern for Factor Analysis of Package 02 Competencies (Harris-Kaiser Independent Clusters Oblique Solution)

COMPE-TENCY	FACTOR 1	2	3	4	5	6
C609	-168		441	-101	220	
C610	321	134	450		-208	-251
C611	-141				113	-654
C613	455	138	221	-159		-123
C614			540			
C615	201		328	-145	105	-172
C616			347		243	115
C617	108		176			-494
C620			515			
C622	356		238	-293	168	
C625			363		166	-213
C626	136	145			-138	-135
C627		106	288	226	131	-165
C628		-107		261	329	-127
C629	314		111	-165	296	
C630			-165		379	
C902		141	393			117
C903		127		382		165
C904	178	159	112		324	-146
C905			373		-310	
C906				-171	296	
C910			-215	183		
C911		515				148
C912		529			199	
C915	-180	191	275		160	216
C917	-116		-153	605	215	-108
C001	-250	-274	267	373		
C002	-122			528		
C003	-277	353	155		343	
C004		531		294		-233
C009	406		-118	218		183
C010			203	212	339	-124
C011	114	300	-166			-147
C012	325			194	-183	-108
C013		198		514	-198	111
C014		132	143	414		
C015	121	148		425	130	
C017		-126		477	-133	
C018			436			174
C019	116	-177		392	-306	
Variance of Oblique Factors	4.790	3.436	3.794	3.681	3.124	2.981

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown. Leading decimal points are omitted.

TABLE E10

Factor Pattern for Factor Analysis of Package 03 Competencies (Harris-Kaiser Independent Clusters Oblique Solution)

COMPETENCY	FACTOR 1	2	3	4	5	6
C310	137			-276	-125	490
C312						713
C361	132	372	261			206
C363		657	143			
C364	-308	183	242	252	-156	
C366		205			364	
C368		261	-260	-112	220	105
C371					730	
C372		416		366		165
C373	129	228	194		124	215
C374		540	300			
C375	100	263		-281		229
C376		437	-119	-168	257	255
C378		267	-471	-224	-219	-207
C401	214	273				102
C402	116	389	132	-300		211
C404	493		143		207	
C405	412	190				134
C406	381		236			176
C407	371	164	222	204	-211	111
C408	139	134		350	-251	
C409	495			112		
C411	215	421	106		-121	
C412	488		167			203
C413	449					-118
C414	-165					
C415	316			-134		-141
C418	212	219	-173	-217	-282	-120

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown.
Leading decimal points are omitted.

TABLE E10

Factor Pattern for Factor Analysis of Package 03 Competencies
(Harris-Kaiser Independent Clusters Oblique Solution)

COMPETENCY	FACTOR 1	2	3	4	5	6
C421	-109	223	-330	160	-369	194
C501		177			506	
C502		117			573	
C506	-136			261	233	
C507		241		346		-157
C508		266	-115	261		
C541		640			108	
C542	-364	236		331		157
C543	-172	697	-170		-121	
C545	-142	437		147	174	
C547				188		-298
C603				145		625
C604					-203	502
C606		-232	-561			
C608	-168		-394	106		298
C610	120		-518			129
C611		-373	-172	138	202	416
C613	101	121	-399	-163	-372	167
C614		236	-422	183	155	
C615			-423	-170		215
C616		144	-432			
C617		-150	-194		134	438
C618	383					
C620		192	-372	161		
C622	-189		-527	-133	-218	-103
C625			-390		221	233
C626	110	-161	-179		237	
C627	143		-414	229	142	

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown.
Leading decimal points are omitted.

TABLE E10

Factor Pattern for Factor Analysis of Package 03 Competencies
(Harris-Kaiser Independent Clusters Oblique Solution)

COMPE-TENCY	FACTOR 1	2	3	4	5	6
C628	-156	-249	-146	336		
C629			-484	-101	-116	-130
C630	-118	-195		147	-125	
C905			-197		314	
C907	261	-152		-117	260	
C908	335	-278		-123	123	269
C910		-154	130			
C911	589			-111		
C912	560		-114	-101		-108
C914	116	434	-243	291	110	-262
C915			-225	105		-227
C916		-211			412	
C917		-220		501	124	
C001		-124		438	211	212
C002				586		
C003	159		-206	132	242	-264
C004	530	-183	-144	228		
C005			128	527		
C006	157		-201		-272	
C009				150	-216	
C010		-138	-461	169		
C011	175	-183			-147	
C012				318	-256	
C013	337		117	459		
C014	313	-101	-168	254		
C015	208	-109		353	-165	103
C016	144	154				
C017				426		172
C018		155	-136	213	-169	
Variance of Oblique Factors	3.973	4.567	4.153	3.780	3.270	3.189

NOTE: Only factor pattern coefficients greater than .100 in absolute value are shown.
Leading decimal points are omitted.

TABLE E11

Correlations Among Oblique Competency Factors: Package 01

FACTOR	FACTOR							
	1	2	3	4	5	6	7	8
1		-389	087	-335	004	-359	433	313
2			-152	309	-103	280	-389	-305
3				-024	009	-173	133	160
4					-067	303	-364	-222
5						070	001	069
6							-383	-343
7								345
8								

NOTE: Leading decimal points are omitted.

TABLE E12

Correlations Among Oblique Competency Factors: Package 02

FACTOR	FACTOR					
	1	2	3	4	5	6
1		-064	122	105	172	-029
2			126	193	007	-013
3				173	159	-172
4					085	-055
5						-118
6						

NOTE: Leading decimal points are omitted.

TABLE E13

Correlations Among Oblique Competency Factors: Package 03

FACTOR	FACTOR 1	2	3	4	5	6
1		024	-136	213	036	029
2			036	096	193	162
3				-121	-043	-134
4					115	031
5						064
6						

NOTE: Leading decimal points are omitted.

TABLE E14

Competencies Selected from Packages 01, 02, and 03 to Form Package 04

COMPETENCY NUMBER			
C102	C363	C610	C825
C105	C371	C611	C826
C106	C374	C613	C828
C107	C404	C614	C830
C109	C408	C616	C831
C115	C409	C617	C832
C116	C412	C620	C911
C202	C413	C622	C912
C203	C415	C625	C916
C205	C417	C629	C917
C206	C420	C729	C001
C208	C501	C801	C002
C209	C502	C802	C004
C211	C541	C807	C005
C218	C543	C810	C009
C223	C603	C811	C010
C302	C604	C812	C013
C304	C607	C815	C015
C307	C608	C819	C017
C310	C609	C822	C018
C312		C824	

TABLE E15

Correlations Among Package 04 Competencies

COMPE-TENCY	COMPETENCY C102	C105	C106	C107	C109	C115	C116	C202	C203	C205	C206	C208
C102	(741)	231	243	057	269	318	198	165	-058	150	270	351
C105		(676)	367	099	119	219	209	114	128	077	160	065
C106			(774)	165	130	286	293	165	134	131	220	134
C107				(692)	230	096	190	105	110	001	051	110
C109					(743)	299	050	088	042	049	143	257
C115						(828)	323	165	110	001	226	215
C116							(764)	-026	067	-009	142	206
C202								(793)	323	177	168	197
C203									(686)	015	-027	-094
C205										(851)	219	015
C206											(688)	431
C208												(798)
C209												
C211												
C218												
C223												
C302												
C304												
C307												
C310												
C312												
C363												
C371												
C374												
C404												
C408												
C409												
C412												
C413												
C415												
C417												
C420												
C501												
C502												
C541												
C543												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPE-TENCY	COMPETENCY											
	C209	C211	C218	C223	C302	C304	C307	C310	C312	C363	C371	C374
C102	118	182	009	225	279	211	102	322	130	-067	-197	- 055
C105	-030	057	063	113	113	035	-153	091	058	-036	033	-032
C106	248	156	120	070	120	047	161	021	-077	136	-011	204
C107	151	144	032	115	-134	025	198	042	-088	-057	-129	-111
C109	038	035	-006	108	108	078	159	195	005	-195	-167	-155
C115	151	069	-051	199	199	150	125	042	-088	-057	-129	-111
C116	-087	185	123	123	013	169	169	-059	-064	040	-093	-006
C202	031	247	070	120	-030	236	-057	244	202	015	-062	055
C203	-020	086	046	-040	-127	-018	-005	-078	159	029	144	165
C205	-105	229	-005	185	375	149	-019	-025	049	029	-058	-011
C206	015	076	058	131	204	224	184	010	-105	066	-080	045
C208	263	008	307	133	133	244	146	180	038	099	-123	036
C209	(847)	-112	295	-004	146	080	137	240	108	204	082	232
C211		(722)	048	297	-014	178	187	-030	-132	016	062	019
C218			(894)	104	-034	-030	089	202	080	089	329	110
C223				(770)	-034	126	-091	100	-017	089	117	-044
C302					(772)	022	-031	100	080	-078	-166	007
C304						(826)	369	-100	-045	217	040	228
C307							(744)	-040	-139	184	-019	167
C310								(787)	360	016	-101	-032
C312									(832)	072	-010	160
C363										(788)	049	566
C371											(744)	025
C374												(770)
C404												
C408												
C409												
C412												
C413												
C415												
C417												
C420												
C501												
C502												
C541												
C543												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPE-TENCY	C404	C408	C409	C412	C413	C415	C417	C420	C501	C502	C541	C543
C102	-116	046	-089	-040	-121	-126	-058	-026	-103	-141	-070	183
C105	024	-004	-035	028	-029	065	-061	014	103	-171	020	164
C106	-186	-077	-010	-033	-145	-055	-055	-096	110	-062	187	366
C107	-030	092	038	-094	-178	005	-099	083	-115	-129	-014	-032
C109	-085	200	050	-088	-072	-030	114	007	-200	-109	-142	-040
C115	-120	024	-025	-094	-039	-099	110	-110	-115	-129	-079	094
C116	-087	050	-086	-068	-129	-072	-072	-079	040	-093	-065	091
C202	-132	088	028	-165	-062	071	-118	-038	-002	-165	148	176
C203	-020	042	084	-089	-024	015	015	097	086	055	140	119
C205	-037	101	042	115	006	-065	-065	-086	-096	-058	042	063
C206	-064	083	-169	080	-091	-118	-027	038	-137	-154	-022	122
C208	-114	114	-244	-089	-096	-094	015	-003	-109	-034	-063	053
C209	-056	-085	-023	-107	-079	-114	-020	-126	120	159	110	257
C211	023	-016	103	024	-006	-070	-070	052	037	-002	172	094
C218	-079	108	-022	-120	-171	-127	-127	099	085	188	162	083
C223	146	108	133	-029	-055	-040	-127	019	007	188	108	135
C302	-079	-006	-022	062	060	046	133	-061	-070	-166	-160	-074
C304	023	078	-100	072	007	-084	-149	-116	-132	-066	-006	074
C307	-059	010	-006	091	-030	-081	071	036	-114	043	045	016
C310	-094	026	100	062	-054	-078	-078	-086	-090	004	075	-018
C312	-101	085	045	048	-069	-084	-084	-092	119	-010	124	033
C363	144	-011	-007	123	-046	-111	-181	-007	040	163	398	356
C371	236	-050	066	071	016	-034	-123	110	333	420	182	-006
C374	010	-028	-035	061	-099	-094	036	-008	145	131	330	321
C404	(765)	038	259	288	172	169	075	135	036	159	052	-026
C408		(715)	050	-013	214	042	186	-059	-073	-050	079	089
C409			(703)	202	254	084	214	116	073	119	046	044
C412				(748)	069	026	255	007	-001	071	096	-060
C413					(747)	122	267	-120	128	-161	-041	-027
C415						(731)	125	-104	-012	-034	-063	-078
C417							(764)	-104	-109	-123	-130	-144
C420								(779)	059	275	-032	-050
C501									(750)	413	132	226
C502										(831)	127	048
C541											(789)	372
C543												(692)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPETENCY	COMPETENCY											
	C603	C604	C607	C608	C609	C610	C611	C613	C614	C616	C617	C620
C102	037	270	-051	128	042	114	016	306	056	080	042	031
C105	072	318	-049	148	-050	142	097	228	097	033	265	-049
C106	-096	062	-190	025	010	193	-176	241	-007	-011	-043	001
C107	-013	-037	037	-056	-037	-090	-070	075	-079	041	-125	-026
C109	007	083	-117	-151	023	188	-151	184	-098	066	023	014
C115	-013	314	-090	066	-125	228	-070	260	-014	-044	-037	037
C116	-079	142	096	099	-090	012	-004	240	-065	019	026	-073
C202	136	273	001	135	010	078	058	204	-046	-013	168	001
C203	097	339	192	172	065	126	266	230	140	-034	156	259
C205	134	019	-219	175	019	169	-096	130	091	202	019	265
C206	-047	-072	-203	030	158	-147	-108	261	034	069	081	-092
C208	-104	-027	-073	-146	-027	-140	-140	036	-198	-123	-118	-206
C209	-039	015	-077	-154	-143	-134	-169	-102	-180	-071	-143	-191
C211	-092	-055	-134	053	-121	056	-104	-073	027	-066	010	008
C218	019	-087	-015	-187	-087	038	-060	110	-053	-024	-087	-173
C223	-061	-014	-173	116	-014	038	-060	007	108	-024	058	038
C302	099	204	-173	015	-014	144	-060	263	054	046	-014	-015
C304	064	059	-190	041	-050	-031	-027	-081	-167	040	169	-071
C307	-034	-133	-159	-269	057	-113	-064	077	-002	043	-007	-159
C310	271	226	065	-030	010	143	172	197	-084	004	226	-092
C312	578	402	259	209	-105	038	236	089	049	-109	199	-036
C363	-007	-052	-183	086	183	-098	-061	027	139	-065	-052	072
C371	-054	-080	002	100	-154	056	082	-132	127	058	144	056
C374	-008	-009	-251	-082	-009	-212	-091	-030	-069	-132	-063	-055
C404	-126	-143	-077	-099	094	095	041	-102	052	-071	015	152
C408	139	-037	-030	-068	-037	144	-151	-028	035	125	-037	144
C409	-004	105	071	-041	050	071	075	043	127	013	-005	031
C412	113	-016	-125	-044	-016	014	-047	061	167	-023	176	084
C413	-053	-030	-017	085	-030	160	-035	-013	004	016	-091	027
C415	-104	065	060	-082	-118	-007	022	-029	072	-034	065	-007
C417	-104	-027	-140	-209	-027	060	-140	-094	072	-123	-118	-073
C420	-115	-047	-044	-032	207	017	220	-008	217	110	122	-044
C501	059	026	116	160	-137	-120	-018	-143	192	096	-056	057
C502	028	-154	002	-004	069	052	082	-238	237	058	069	110
C541	092	-079	-145	-133	147	059	-144	011	168	182	-079	182
C543	011	067	-099	104	122	-019	-117	204	128	209	067	021

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPETENCY	C622	C625	C629	C729	C801	C802	C807	C810	C811	C812	C815	C819
C102	025	051	009	-126	183	001	298	016	060	031	118	-026
C105	136	-011	113	065	-025	-192	020	-090	-084	-169	-030	-138
C106	143	039	170	197	063	-078	-051	-129	-132	-099	-078	-085
C107	127	004	199	110	-032	-030	-051	086	061	016	151	060
C109	300	024	051	-030	133	-023	140	-044	038	-013	162	023
C115	212	-129	282	-099	031	-030	153	008	-030	016	-120	060
C116	019	035	233	-072	007	033	045	-107	152	-068	033	079
C202	195	119	070	-055	252	-078	072	011	-023	100	-023	137
C203	144	162	046	015	119	-114	-035	-059	-114	141	-020	232
C205	072	171	122	-144	447	-037	349	082	238	031	376	047
C206	144	-117	131	-118	232	173	252	028	173	-016	015	002
C208	-034	-185	046	015	119	263	248	104	075	026	169	001
C209	-071	-104	-079	546	-083	-056	031	041	-137	090	025	-052
C211	-002	205	-014	086	282	091	279	128	158	271	158	145
C218	-095	025	-103	394	083	071	042	198	071	062	445	161
C223	117	190	035	046	030	-004	099	069	295	244	071	038
C302	-095	190	035	-127	187	071	155	004	-004	062	146	-023
C304	-173	-089	-133	-018	389	192	445	070	249	210	136	206
C307	-143	-020	-031	071	198	333	197	218	203	250	137	333
C310	109	092	-003	051	-096	-094	-063	172	-094	-074	128	-035
C312	-010	143	-113	039	106	-101	-079	-034	-101	-079	004	-050
C363	-122	000	-133	099	-066	083	205	-009	144	-024	023	003
C371	-088	097	-095	323	102	-071	-058	016	-148	164	005	177
C374	-132	-028	-198	230	048	065	126	005	065	-007	010	003
C404	-071	015	-079	075	-083	106	031	-029	025	-009	-056	081
C408	066	-068	-006	-101	046	-023	093	009	286	062	162	023
C409	-094	048	-074	084	005	-023	064	173	-023	134	-023	117
C412	-116	043	-120	026	147	189	-019	124	-107	157	-107	017
C413	-161	-010	-055	-096	-114	-016	-082	019	-204	-007	-204	-069
C415	-034	092	-127	-094	-013	-114	-106	-059	-020	-089	-114	001
C417	-034	-116	-127	-094	119	169	036	266	-020	141	-114	155
C420	110	179	019	-004	-050	-039	-131	145	-039	219	048	-027
C501	-142	156	007	280	050	-132	-079	-018	-132	101	-132	-040
C502	-088	097	046	323	-059	005	-058	082	005	258	005	052
C541	-093	082	001	275	-156	-122	022	-093	052	-045	-006	-130
C543	-006	047	030	185	-032	-254	032	-117	-026	-060	-083	-201

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPE-TENCY	COMPETENCY C822	C824	C825	C826	C828	C830	C831	C832	C911	C912	C916	C917
C102	168	197	-080	181	031	191	205	156	-031	-088	-084	056
C105	-072	108	-057	-082	-168	-069	-055	-102	-139	-169	028	-096
C106	-022	074	-053	-159	-161	-062	050	-043	-089	-201	030	-163
C107	108	-093	-082	-098	016	041	-057	-125	044	161	-043	-014
C109	024	159	111	047	-086	417	203	143	-077	-036	-075	-009
C115	-020	125	-082	-098	-064	041	024	-037	-016	-045	-043	-144
C116	101	073	-059	-028	002	245	222	026	-106	-041	-031	192
C202	055	161	244	099	078	040	245	115	-162	-118	166	-163
C203	-068	-081	051	-012	-053	-034	038	065	-181	-030	195	-130
C205	179	368	069	353	034	137	108	019	085	049	-062	140
C206	250	247	118	173	038	144	190	158	010	-097	-051	034
C208	200	222	180	213	030	412	377	339	-055	-101	-041	005
C209	-128	-059	-094	-065	-092	005	-086	173	031	-085	-049	-122
C211	305	133	154	281	202	189	400	141	-250	-222	105	027
C218	152	270	100	316	080	117	226	276	-030	-120	132	054
C223	312	270	100	079	080	188	226	058	020	-063	-054	162
C302	-060	149	-003	139	-052	046	092	058	220	051	-055	054
C304	221	097	-023	215	-011	147	157	224	010	-136	049	156
C307	221	-156	-040	198	119	228	193	184	-057	-139	096	-002
C310	-088	139	-064	043	083	004	-009	010	021	111	-034	-084
C312	-031	029	-069	106	-029	-010	-023	-105	-077	005	-036	-026
C363	084	-107	-067	026	-208	-122	-090	007	-026	-103	-078	-121
C371	009	-019	004	034	-042	-088	-033	069	-062	-050	331	072
C374	076	-057	045	061	-223	-132	-010	099	-094	-113	-096	-109
C404	045	-059	-094	-065	-164	-148	-159	-064	140	100	-049	110
C408	200	209	111	145	-032	183	092	203	088	106	-075	124
C409	019	-188	-209	-036	-088	-094	-056	-169	254	179	092	127
C412	020	-069	-074	005	-041	-023	-124	-112	100	213	-038	238
C413	-095	-130	-140	-189	-134	-102	-067	-030	273	118	-072	-086
C415	-135	-005	180	-086	030	-034	038	-027	134	257	195	005
C417	-001	-081	-079	-012	030	055	038	-027	134	042	-041	005
C420	085	-034	033	097	003	-136	167	038	020	073	173	154
C501	-055	-114	-090	-120	-083	-142	-077	-137	-002	-009	163	011
C502	-045	-143	004	-027	-042	-015	-033	-005	143	183	139	072
C541	-093	-095	075	-061	-080	-093	-014	-022	-046	035	-085	-123
C543	-128	-121	-096	-134	-253	-113	-089	-098	-165	-127	-091	-116

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPETENCY	C001	C002	C004	C005	C009	C010	C013	C015	C017	C018
C102	-074	013	019	174	150	079	079	080	121	150
C105	-070	-046	-016	-103	108	099	-065	142	020	012
C106	-087	-071	-148	-099	205	010	-002	091	-051	-020
C107	-117	007	-010	-094	125	158	-115	179	017	-178
C109	-211	-122	057	-013	209	100	-009	113	047	-072
C115	-176	-055	050	-094	271	099	-022	-058	-051	-039
C116	-020	072	058	-068	361	164	040	214	045	-129
C202	-016	004	-075	-165	074	081	-115	-016	031	-020
C203	-027	094	-050	026	-081	011	-012	-027	-035	-024
C205	-018	261	048	-053	-019	039	117	-018	142	-100
C206	-111	038	-195	-016	120	-064	107	-008	015	031
C208	-150	030	-114	-089	146	011	086	-150	035	-024
C209	-191	-163	-235	-009	-059	-252	-048	-245	-092	-141
C211	046	194	-016	024	241	105	107	135	-076	-162
C218	-060	000	-123	-120	-091	-205	007	-158	042	-113
C223	184	102	078	062	149	087	239	086	267	-055
C302	-158	-051	128	-029	089	-059	085	-011	042	002
C304	-097	-017	-091	004	233	061	043	050	106	-037
C307	-301	068	-092	-069	159	-068	021	041	-049	-181
C310	-058	-112	026	-074	049	-027	-090	014	021	032
C312	113	083	068	048	029	-127	-097	-024	157	011
C363	-012	016	-178	-024	136	-058	102	-170	023	001
C371	166	018	-055	-023	-143	014	096	-085	000	-043
C374	-099	-081	-193	061	122	-193	030	-099	-126	-142
C404	127	058	256	-009	-059	013	288	074	031	046
C408	073	215	223	138	010	060	183	113	326	023
C409	024	209	356	202	039	233	190	245	021	080
C412	007	123	238	-084	-069	-022	306	201	-019	-083
C413	096	062	158	-007	-080	203	192	096	012	083
C415	-212	-034	203	-089	-081	011	-012	097	-106	-024
C417	-150	-034	076	-089	-005	-112	183	097	-036	-024
C420	084	104	-091	113	-034	182	-121	027	000	081
C501	161	023	060	101	-047	094	-040	106	047	-131
C502	166	070	048	164	-143	-036	175	-035	-116	076
C541	-056	039	-074	-045	-048	022	011	-018	-022	049
C543	-004	036	-078	078	016	-032	-009	-041	-011	061

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPETENCY	COMPETENCY											
	C603	C604	C607	C608	C609	C610	C611	C613	C614	C616	C617	C620
C603	(809)	207	139	202	038	139	295	051	092	110	207	200
C604		(858)	130	189	-149	019	300	261	-022	-005	158	019
C607			(773)	206	-092	074	335	101	018	-106	241	-047
C608				(811)	030	206	256	144	259	152	189	168
C609					(683)	130	232	207	316	218	081	186
C610						(854)	138	258	264	110	241	235
C611							(759)	101	157	016	368	-010
C613								(847)	131	078	153	062
C614									(765)	292	203	223
C616										(755)	069	272
C617											(710)	-148
C620												(797)
C622												
C625												
C629												
C729												
C801												
C802												
C807												
C810												
C811												
C812												
C815												
C819												
C822												
C824												
C825												
C826												
C828												
C830												
C831												
C832												
C911												
C912												
C916												
C917												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPETENCY	COMPETENCY											
	C622	C625	C629	C729	C801	C802	C807	C810	C811	C812	C815	C819
C603	-054	243	-141	-003	193	-039	000	-005	047	007	048	044
C604	-005	058	-014	-118	122	-064	015	-108	-064	-112	015	131
C607	002	058	091	-073	-099	-020	-215	-109	-191	-125	-020	040
C608	100	181	066	-082	104	-264	-010	-217	-209	-044	-154	-156
C609	069	116	131	-118	-154	094	-045	-040	015	080	-143	002
C610	272	227	249	060	061	-134	-129	-109	-077	014	038	-053
C611	016	240	069	-140	-068	-029	-105	-027	-099	038	-029	059
C613	131	136	212	-158	048	-102	-126	-187	-102	-075	010	003
C614	127	210	108	005	128	-064	-066	107	-006	167	-122	-035
C616	058	097	117	055	155	-148	058	016	082	-023	005	-136
C617	218	174	058	-027	122	-143	-045	028	-064	080	-064	066
C620	110	227	038	-073	021	-077	043	-109	-077	014	-134	040
C622	(712)	041	258	-034	-113	-148	-116	-116	005	-116	-072	-074
C625		(674)	080	023	130	-104	-124	034	016	189	016	042
C629			(752)	-040	-179	-004	-127	005	-079	-120	-154	-145
C729				(812)	-078	-114	-036	022	-114	026	-020	-076
C801					(832)	258	459	275	258	286	314	402
C802						(814)	153	251	188	189	106	480
C807							(802)	264	397	056	336	212
C810								(806)	181	465	251	345
C811									(809)	090	431	214
C812										(830)	090	422
C815											(851)	280
C819												(774)
C822												
C824												
C825												
C826												
C828												
C830												
C831												
C832												
C911												
C912												
C916												
C917												

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPETENCY	COMPETENCY C822	C824	C825	C826	C828	C830	C831	C832	C911	C912	C916	C917
C603	-100	036	-086	-040	003	-054	-146	-131	-038	007	-045	030
C604	-141	-070	010	-015	-101	-005	-094	005	-043	023	146	034
C607	-116	-113	-170	-080	-096	-106	-082	-148	001	057	054	100
C608	-040	-005	-180	-075	-143	-159	-213	-236	-085	-068	-036	063
C609	027	-133	010	-015	038	-154	-023	005	-043	083	-051	-079
C610	-116	117	-092	-080	-096	-106	-030	-036	-037	-030	054	-023
C611	-101	-177	-116	-017	045	-116	-007	-108	-036	009	115	107
C613	-082	-012	-032	-116	-076	-027	-010	-063	018	184	-096	-109
C614	113	-142	-163	031	073	-148	-067	-192	-046	035	206	043
C616	-100	-019	-101	-027	-042	058	-102	-005	041	125	-053	127
C617	-141	-070	-098	-015	038	-080	-023	-072	-096	-037	146	091
C620	-035	071	-014	-034	106	056	-133	019	040	057	-089	059
C622	118	166	004	-149	026	-088	-033	-154	-062	067	-053	-038
C625	-057	028	011	015	154	-016	172	-059	-081	069	070	-004
C629	-007	-031	-105	-158	-052	-095	-110	-160	070	165	-055	-053
C729	-135	-157	-078	-086	-136	-034	-132	065	-055	-102	-041	005
C801	235	198	137	451	147	263	320	177	-051	-127	194	169
C802	333	072	351	321	122	236	280	252	085	-085	-049	110
C807	271	197	021	472	014	231	193	252	-010	-140	-077	109
C810	247	049	-020	371	291	016	183	028	105	-044	115	107
C811	391	203	128	256	194	236	280	173	-023	038	-049	227
C812	301	-069	062	240	394	164	232	272	-033	-088	209	096
C815	218	333	128	514	122	236	207	173	-023	-024	-050	227
C819	191	-041	146	265	364	177	265	195	003	-078	266	155
C822	(767)	360	228	478	217	227	289	306	-061	-108	057	154
C824		(764)	317	405	119	228	251	247	-057	-039	-068	139
C825			(860)	395	084	319	491	442	-202	-058	-034	-004
C826				(886)	221	338	470	423	-202	-198	092	169
C828					(705)	228	325	177	-066	-032	120	124
C830						(806)	519	442	-165	-226	-053	292
C831							(860)	403	-146	-186	126	143
C832								(789)	-201	-217	-051	034
C911									(726)	502	-106	148
C912										(783)	-075	035
C916											(706)	060
C917												(728)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPE-TENCY	COMPETENCY C001	C002	C004	C005	C009	C010	C013	C015	C017	C018
C603	084	104	026	007	036	-045	-031	141	131	014
C604	-059	038	069	176	120	090	-056	044	134	092
C607	092	050	244	154	-159	098	-120	-021	043	-017
C608	264	082	-025	022	-049	349	-010	-059	113	085
C609	096	038	-037	080	-133	142	107	096	074	335
C610	092	011	205	-195	-021	284	-002	017	043	160
C611	144	140	067	038	-121	198	055	006	000	019
C613	-208	-005	181	-075	032	061	-028	119	-084	158
C614	172	118	043	096	-095	060	071	058	022	228
C616	-035	018	099	-023	-143	214	-142	116	000	135
C617	096	-070	069	-016	-070	039	-137	044	015	-030
C620	054	089	013	084	-067	172	175	092	086	204
C622	016	-139	-004	-116	104	164	-142	-135	000	076
C625	046	124	090	-030	-020	079	033	085	-034	-148
C629	-011	000	128	-120	089	234	-147	-011	-183	003
C729	-027	-099	-114	026	-081	-051	-109	-027	-106	-097
C801	-004	152	-001	009	107	-106	050	108	075	-158
C802	-085	058	038	-009	203	-040	288	074	031	-016
C807	-110	073	-082	130	197	000	047	010	035	-035
C810	052	045	-122	-047	105	-167	055	052	-105	-089
C811	-032	169	038	090	268	-093	204	021	214	-079
C812	137	190	039	036	011	-022	203	137	-019	-007
C815	-085	058	092	-008	072	-093	036	021	153	-204
C819	-065	085	012	017	173	-005	166	109	112	-120
C822	037	261	028	160	267	-034	183	075	184	038
C824	-002	023	-005	011	160	-153	088	041	197	-130
C825	-131	040	026	062	049	-172	140	-058	021	032
C826	-024	227	022	162	-009	-171	013	018	230	-041
C828	032	063	-154	-041	062	-055	-010	032	014	-078
C830	-085	227	048	071	166	-036	254	066	173	-161
C831	-037	231	009	054	310	-033	225	011	138	-123
C832	-008	145	-037	176	-007	-167	189	044	015	031
C911	-016	-071	216	034	030	116	166	091	-010	106
C912	-130	047	389	062	-089	100	055	194	-093	071
C916	-012	041	-104	-038	-068	005	-047	-144	077	-073
C917	210	237	160	167	045	250	312	172	284	-086

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

TABLE E15

Correlations Among Package 04 Competencies

COMPETENCY	C001	C002	C004	C005	C009	C010	C013	C015	C017	C018
C001	(750)	244	004	137	-087	090	216	270	130	178
C002		(692)	203	257	112	188	366	208	115	105
C004			(815)	105	-005	205	286	218	082	074
C005				(673)	011	-022	203	137	205	298
C009					(723)	103	156	212	049	-080
C010						(773)	-015	194	120	121
C013							(851)	161	111	063
C015								(842)	170	014
C017									(706)	012
C018										(707)

NOTE: Correlations are phi coefficients. Diagonal elements are squared multiple correlations which were used as estimates of communality in the factor analysis. Leading decimal points are omitted.

APPENDIX F

FIGURES FOR FACTOR ANALYSIS SCREE TESTS

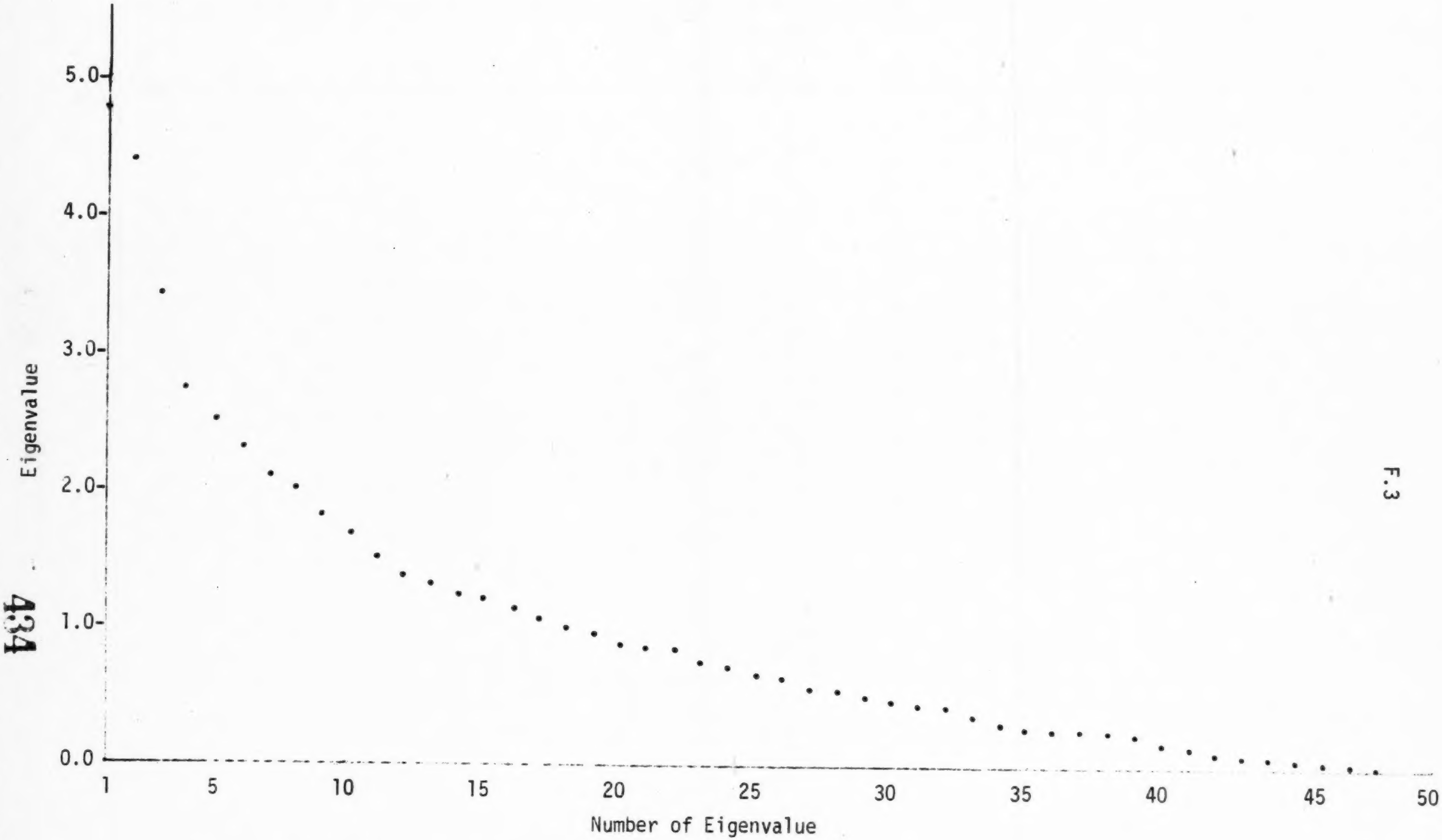


Figure Fl. Graph of Eigenvalue Against Number of Eigenvalue for Factor Analysis of Tasks

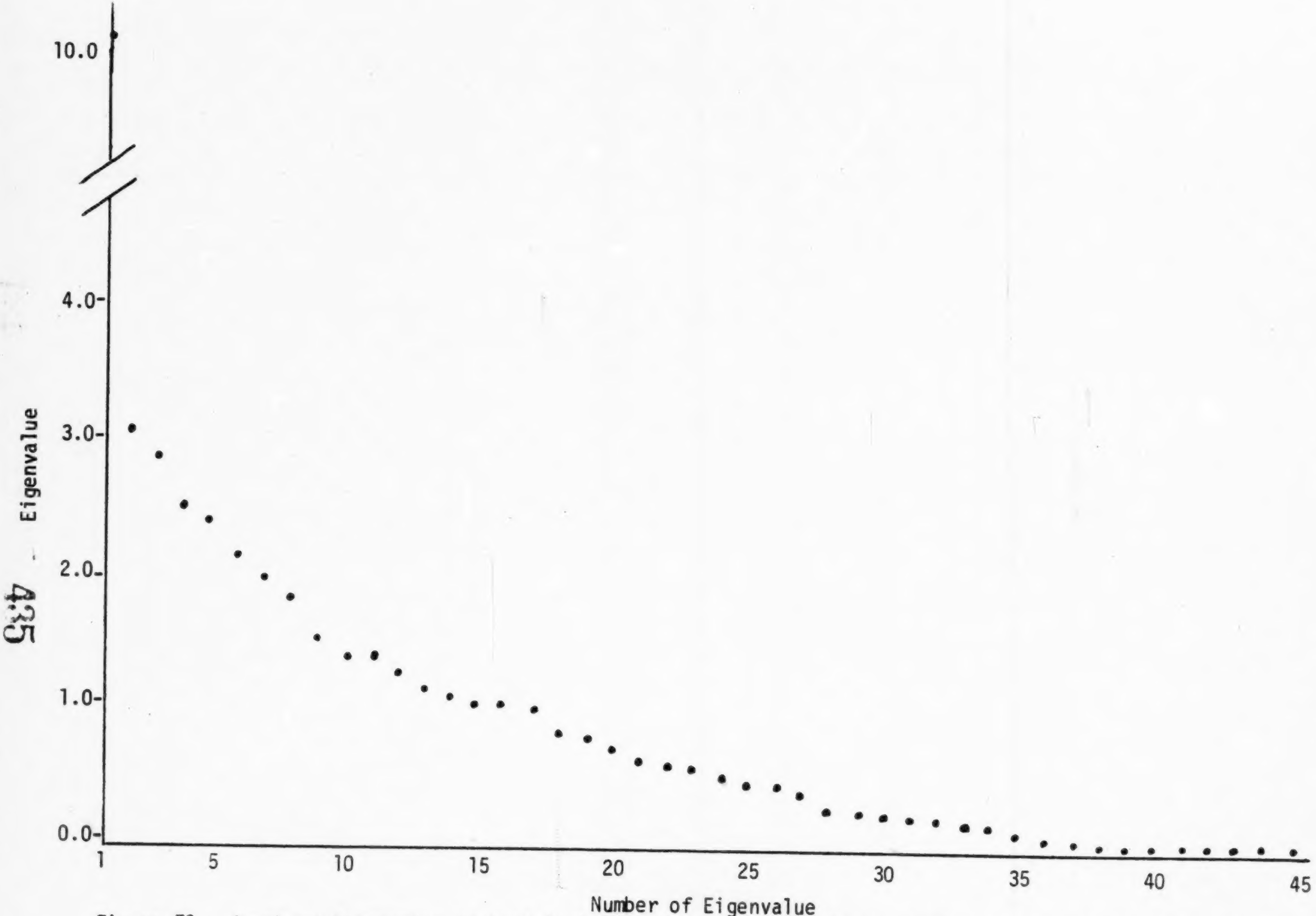
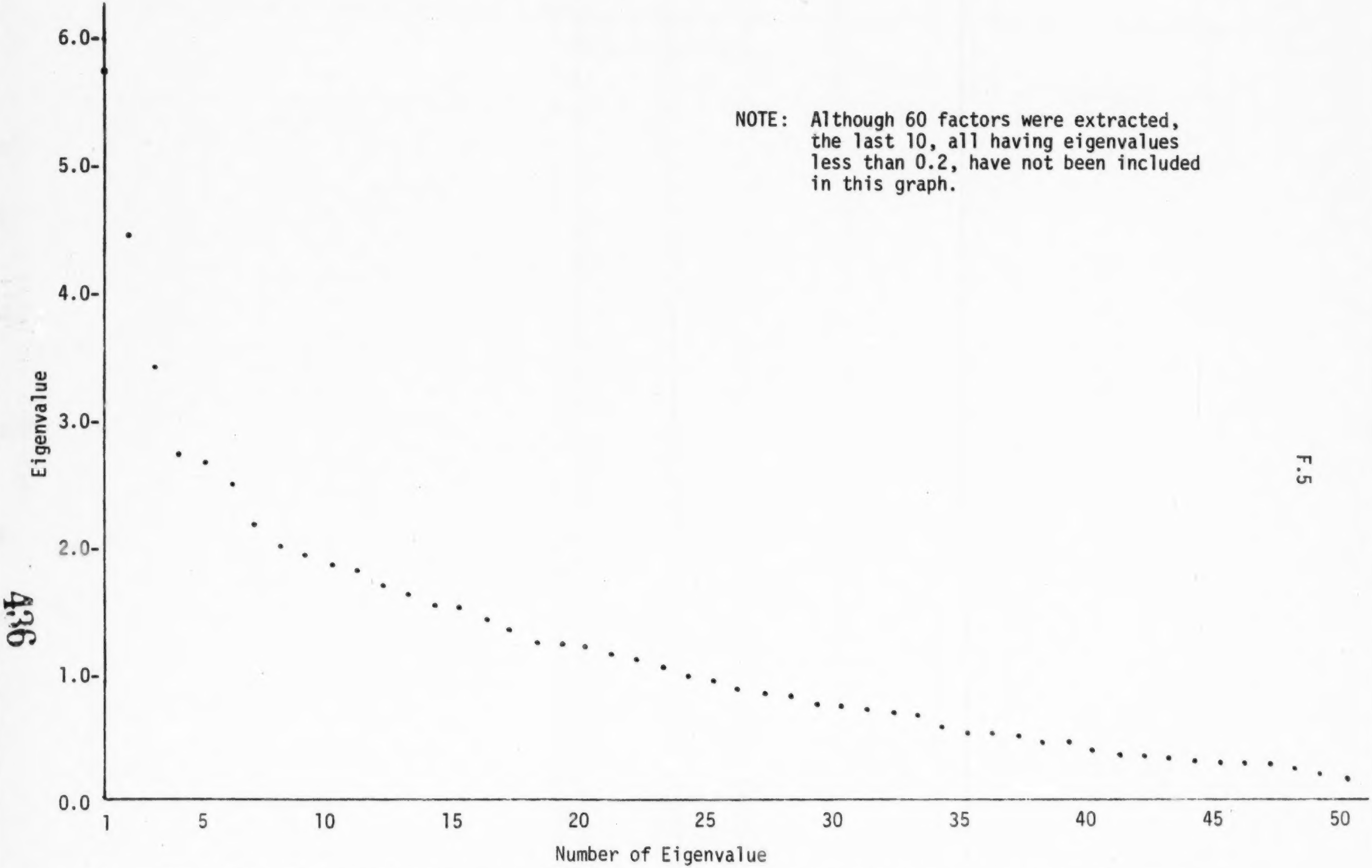
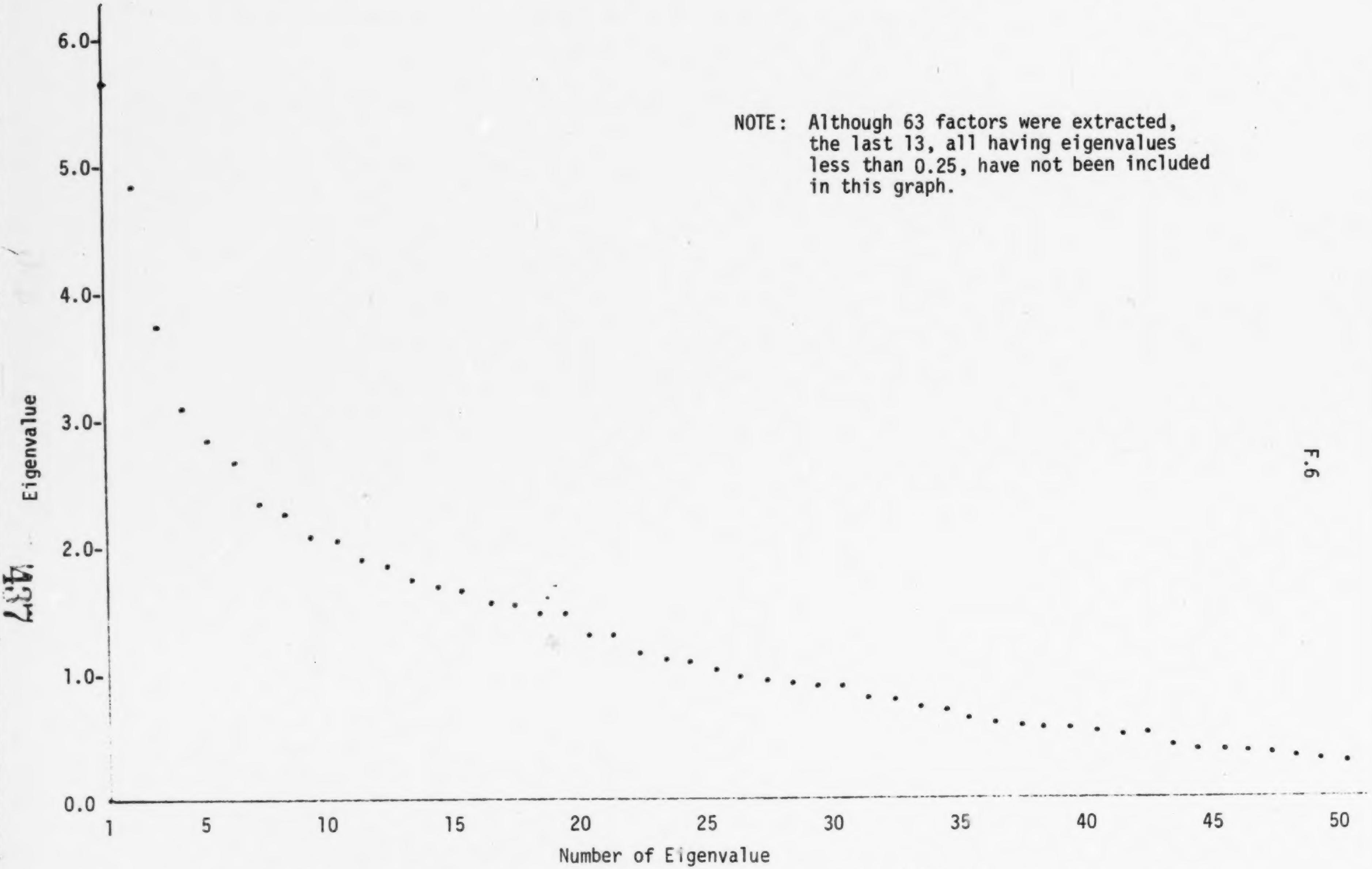


Figure F2. Graph of Eigenvalue Against Number of Eigenvalue for Factor Analysis of Package 01 Competencies



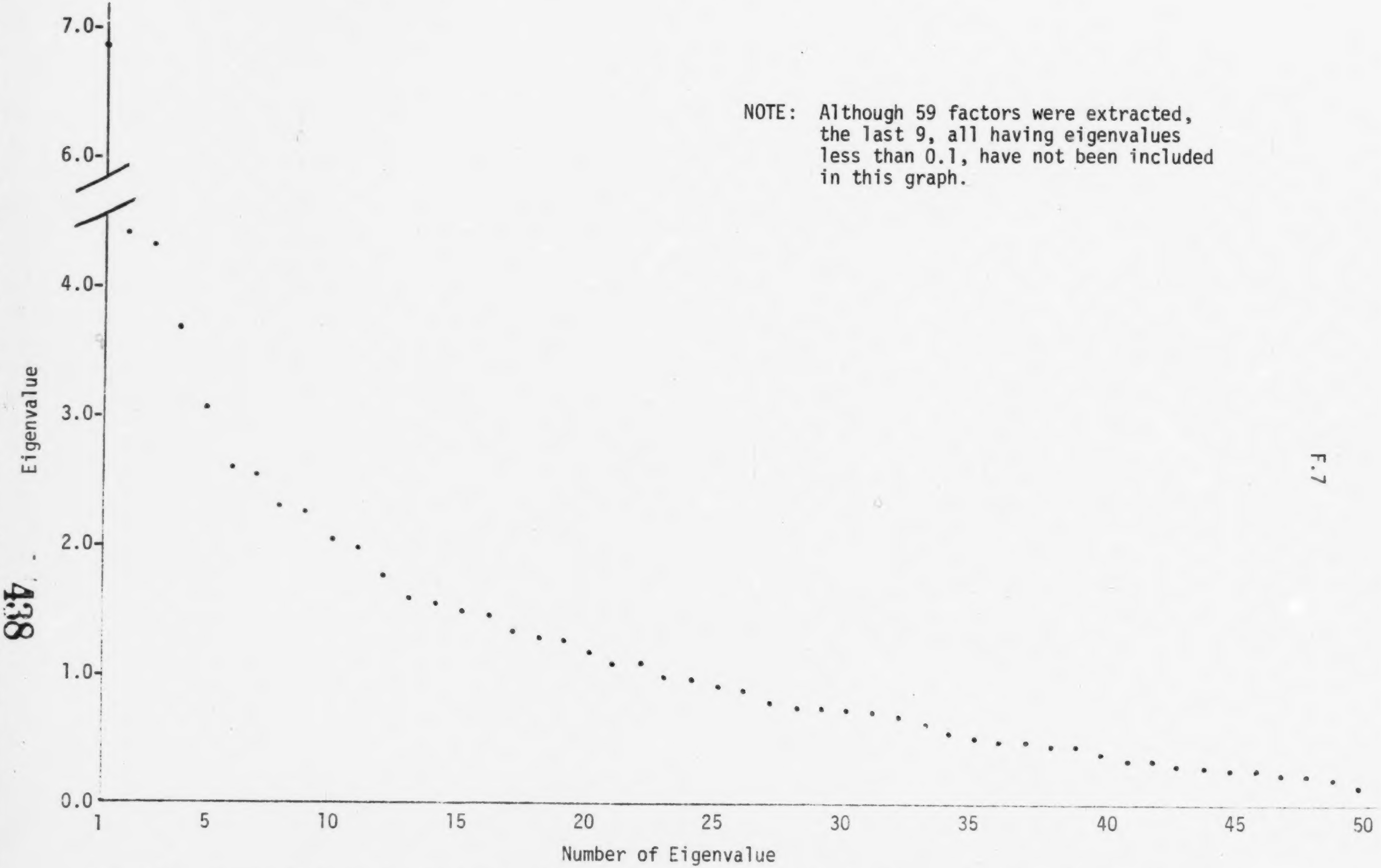
NOTE: Although 60 factors were extracted, the last 10, all having eigenvalues less than 0.2, have not been included in this graph.

Figure F3. Graph of Eigenvalue Against Number of Eigenvalue for Factor Analysis of Package 02 Competencies



NOTE: Although 63 factors were extracted, the last 13, all having eigenvalues less than 0.25, have not been included in this graph.

Figure F4. Graph of Eigenvalue Against Number of Eigenvalue for Factor Analysis of Package 03 Competencies



NOTE: Although 59 factors were extracted, the last 9, all having eigenvalues less than 0.1, have not been included in this graph.

Figure F5. Graph of Eigenvalue Against Number of Eigenvalue for Factor Analysis of Package 04 Competencies

APPENDIX G

SELF-REPORT OF SELECTED COMPETENCIES AND SUGGESTED DIRECTIONS FOR THE INSTRUMENT

Directions

In responding to this instrument, you are asked to do two things: first, react to a checklist of ____ items by indicating the level of competence you feel you possess in each specified area; and second, indicate whether or not you need additional training in each specified area.

In using the checklist, please keep in mind the following interpretations for each of the three competency (ability or knowledge) categories you might choose:

High Degree of Knowledge or Ability: This category refers to a level of competence that enables you to proceed independently or take primary responsibility for an activity in the area.

Moderate Knowledge or Ability: This category refers to a level of competence less than that in the category above, but sufficient to enable you to communicate intelligently about the area or be a team member on an activity in the area.

Almost No Knowledge or Ability: This category refers to a level of competence insufficient to be classified in either of the first two categories.

In responding to each of the ____ items, please make two check-markers, one in ONE of the columns to the left of the item, and one in a column to the right of the item.

CHECKLIST OF SELECTED SKILLS AND KNOWLEDGE NECESSARY IN INQUIRY AND INQUIRY-RELATED ACTIVITIES IN EDUCATION

How much knowledge or ability do you possess in each of the following areas?

(Check ONE column for each item)

In which of the following areas do you feel you need additional training?

(Check ONE column for each item)

High Degree of Knowledge or Ability	Moderate Knowledge or Ability	Almost No Knowledge or Ability		Need Additional Training	Do Not Need Additional Training
			1. Ability to use editorial skills on one's own writing or that of others.		
			2. Knowledge of alternative sources of funding for a proposal and requirements for writing proposals appropriate for each source.		
			3. Ability to discuss the advantages of establishing evaluation systems in educational institutions.		
			4. Ability to write in a style and at a level appropriate to a specified audience.		
			5. Ability to determine the evaluative questions which must be asked in an evaluation and the information which must be gathered to answer those questions.		
			6. Ability to help persons responsible for educational activities or institutions identify and articulate the objectives of the activity or institution.		
			7. Knowledge of various evaluation models (e.g., Stake, CIPP).		

(Continued)

CHECKLIST OF SELECTED SKILLS AND KNOWLEDGE NECESSARY IN INQUIRY AND INQUIRY-RELATED ACTIVITIES IN EDUCATION

How much knowledge or ability do you possess in each of the following areas?

(Check ONE column for each item)

In which of the following areas do you feel you need additional training?

(Check ONE column for each item)

High Degree of Knowledge or Ability	Moderate Knowledge or Ability	Almost No Knowledge or Ability		Need Additional Training	Do Not Need Additional Training
			8. Ability to identify and articulate an evaluation problem.		
			9. Ability to design and conduct interviews for the purpose of collecting data.		
			10. Ability to incorporate systematic evaluation procedures in plans for developing educational programs.		
			11. Ability to plan data collection procedures appropriate to a research or evaluation activity.		
			12. Knowledge of measurement theory and techniques.		
			13. Knowledge of general principles of instrument construction.		
			14. Knowledge of specific questionnaire construction techniques.		
			15. Knowledge of appropriate uses for questionnaires.		

(Continued)

CHECKLIST OF SELECTED SKILLS AND KNOWLEDGE NECESSARY IN INQUIRY AND INQUIRY-RELATED ACTIVITIES IN EDUCATION

How much knowledge or ability do you possess in each of the following areas?

(Check ONE column for each item)

In which of the following areas do you feel you need additional training?

(Check ONE column for each item)

High Degree of Knowledge or Ability	Moderate Knowledge or Ability	Almost No Knowledge or Ability		Need Additional Training	Do Not Need Additional Training
			16. Ability to construct instruments to assess attitudes and other affective variables.		
			17. Ability to select appropriate standardized tests or instruments.		
			18. Ability to write unambiguous items in vocabulary appropriate to the audience.		
	✓		19. Ability to conduct item analyses, including computation of difficulty and discrimination indices.		
			20. Knowledge of survey research designs and techniques.		
			21. Knowledge of general principles of research design.		
			22. Knowledge of specific experimental and quasi-experimental designs.		
			23. Knowledge of factors which jeopardize internal and external validity.		

(Continued)

CHECKLIST OF SELECTED SKILLS AND KNOWLEDGE NECESSARY IN INQUIRY AND INQUIRY-RELATED ACTIVITIES IN EDUCATION

How much knowledge or ability do you possess in each of the following areas?

(Check ONE column for each item)

In which of the following areas do you feel you need additional training?

(Check ONE column for each item)

High Degree of Knowledge or Ability	Moderate Knowledge or Ability	Almost No Knowledge or Ability		Need Additional Training	Do Not Need Additional Training
			24. Ability to operationalize a research design into specific research procedures.		
			25. Ability to design studies to control extraneous variables.		
			26. Knowledge of sampling theory and techniques.		
			27. Ability to identify and articulate a researchable problem.		
			28. Ability to formulate testable hypotheses or researchable questions.		
			29. Knowledge of procedures and steps in developing curriculum materials.		
			30. Knowledge of systems analysis concepts and techniques.		
			31. Ability to state objectives in measurable terms.		
			32. Knowledge of mass production of curriculum materials (e.g., reproduction and packaging processes).		

(Continued)

CHECKLIST OF SELECTED SKILLS AND KNOWLEDGE NECESSARY IN INQUIRY AND INQUIRY-RELATED ACTIVITIES IN EDUCATION

How much knowledge or ability do you possess in each of the following areas?

(Check ONE column for each item)

In which of the following areas do you feel you need additional training?

(Check ONE column for each item)

High Degree of Knowledge or Ability	Moderate Knowledge or Ability	Almost No Knowledge or Ability		Need Additional Training	Do Not Need Additional Training
			33. Knowledge of printing constraints and specifications (e.g., type size).		
			34. Knowledge of design stages in developing audio-visual or multi-media materials.		
			35. Knowledge of various instructional approaches that might be incorporated into curriculum materials.		
			36. Knowledge of effective proposal-writing techniques.		
			37. Ability to identify educational needs.		
			38. Ability to determine what financial resources are necessary to conduct a program or project.		
			39. Ability to use accounting procedures to operate within a program or project budget.		
			40. Ability to plan and manage day-to-day activities of an on-going program or project.		

(Continued)

CHECKLIST OF SELECTED SKILLS AND KNOWLEDGE NECESSARY IN INQUIRY AND INQUIRY-RELATED ACTIVITIES IN EDUCATION

How much knowledge or ability do you possess in each of the following areas?

(Check ONE column for each item)

In which of the following areas do you feel you need additional training?

(Check ONE column for each item)

High Degree of Knowledge or Ability	Moderate Knowledge or Ability	Almost No Knowledge or Ability		Need Additional Training	Do Not Need Additional Training
			41. Knowledge of management and planning techniques (e.g., PERT, PPBS).		
			42. Knowledge of effective techniques of recruiting, interviewing, and hiring personnel.		
			43. Knowledge of various formal and informal systems of recording observations of behavior (e.g., Interaction Analysis).		
			44. Ability to use formal or informal systems of recording observations of behavior.		
			45. Ability to choose appropriate statistical techniques for data analysis.		
			46. Knowledge of descriptive statistical techniques (e.g., means, standard deviations).		
			47. Knowledge of ANOVA or ANCOVA designs and techniques.		
			48. Knowledge of correlational techniques.		
			49. Knowledge of statistical regression techniques.		
			50. Knowledge of t-tests and critical ratios.		

(Continued)

CHECKLIST OF SELECTED SKILLS AND KNOWLEDGE NECESSARY IN INQUIRY AND INQUIRY-RELATED ACTIVITIES IN EDUCATION

How much knowledge or ability do you possess in each of the following areas?

(Check ONE column for each item)

In which of the following areas do you feel you need additional training?

(Check ONE column for each item)

High Degree of Knowledge or Ability	Moderate Knowledge or Ability	Almost No Knowledge or Ability		Need Additional Training	Do Not Need Additional Training
			51. Knowledge of instrument reliability, including types of reliability coefficients.		
			52. Knowledge of instrument validity, including various approaches to determining validity.		
			53. Knowledge of factor analytic techniques.		
			54. Knowledge of distribution theory and distributions commonly used in statistics.		
			55. Knowledge of non-parametric statistical techniques.		
			56. Knowledge of theoretical assumptions underlying various statistical techniques.		
			57. Knowledge of alternate methods of presenting data (e.g., graphs, tables).		
			58. Ability to use standardized ("canned") computer programs (e.g., BMD series).		
			59. Ability to design card layouts to allow data analysis within computer constraints.		
			60. Ability to write computer programs.		

(Continued)

CHECKLIST OF SELECTED SKILLS AND KNOWLEDGE NECESSARY IN INQUIRY AND INQUIRY-RELATED ACTIVITIES IN EDUCATION

How much knowledge or ability do you possess in each of the following areas ?

(Check ONE column for each item)

In which of the following areas do you feel you need additional training?

(Check ONE column for each item)

High Degree of Knowledge or Ability	Moderate Knowledge or Ability	Almost No Knowledge or Ability		Need Additional Training	Do Not Need Additional Training
			61. Knowledge of capabilities of computer systems you use.		
			62. Ability to read and interpret computer output.		
			63. Ability to lead group discussions, moderate meetings, or facilitate constructive interactions among personnel.		
			64. Ability to use library research techniques (e.g., indices to periodicals).		
			65. Ability to use ERIC or other information retrieval systems.		
			66. Ability to obtain and use feedback for management purposes in an on-going program or project.		
			67. Knowledge of techniques for assessing student achievement in relation to behavioral outcomes.		
			68. Knowledge of systems developed to categorize human behavior or abilities (e.g., Bloom's taxonomy).		
			69. Ability to plan an effective development program or project.		

(Continued)

CHECKLIST OF SELECTED SKILLS AND KNOWLEDGE NECESSARY IN INQUIRY AND INQUIRY-RELATED ACTIVITIES IN EDUCATION

How much knowledge or ability do you possess in each of the following areas?

(Check ONE column for each item)

In which of the following areas do you feel you need additional training?

(Check ONE column for each item)

High Degree of Knowledge or Ability	Moderate Knowledge or Ability	Almost No Knowledge or Ability		Need Additional Training	Do Not Need Additional Training
			70. Ability to sequence learning activities to facilitate student learning in curriculum or set of curriculum materials.		
			71. Ability to use field testing techniques during preliminary tryout or implementation of new curriculum materials.		
			72. Ability to develop appropriate product specifications for new educational products.		
			73. Ability to critique a written or oral presentation.		
			74. Ability to determine when an educational product has been tested sufficiently to warrant dissemination and adoption.		
			75. Ability to interpret and integrate statistical data into a meaningful presentation.		
			76. Ability to organize and classify information into meaningful categories.		
			77. Ability to develop and apply an effective system for summarizing and recording information obtained through a manual search of library sources and references.		

(Continued)

CHECKLIST OF SELECTED SKILLS AND KNOWLEDGE NECESSARY IN INQUIRY AND INQUIRY-RELATED ACTIVITIES IN EDUCATION

How much knowledge or ability do you possess in each of the following areas?

(Check ONE column for each item)

In which of the following areas do you feel you need additional training?

(Check ONE column for each item)

High Degree of Knowledge or Ability	Moderate Knowledge or Ability	Almost No Knowledge or Ability		Need Additional Training	Do Not Need Additional Training
			78. Ability to communicate orally in a clear and effective manner.		

APPENDIX H

SELF-REPORT ITEMS CROSS-KEYED WITHIN EACH OF SEVEN TASK CATEGORIES AND FOUR CATEGORIES OF RDDE

ITEMS CROSS-KEYED WITH TASK CATEGORIES AND RDDE CATEGORIES

Competency # (from Appendix D)	Item #	Item	Task Categories							RDDE Emphasis			
			1	2	3	4	5	6	7	R	D	D	E
C 003	1	Ability to use editorial skills on one's own writing or that of others.				x				(x)*		x	
C 018	2	Knowledge of alternative sources of funding for a proposal and requirements for writing proposals appropriate for each source.							x				
C 102	3	Ability to discuss the advantages of establishing evaluation systems in educational institutions.					x			(x)			x
C 010	4	Ability to write in a style and at a level appropriate to a specified audience.		x	x	x			x	(x)	x	x	
C 107	5	Ability to determine the evaluative questions which must be asked in an evaluation and the information which must be gathered to answer those questions.			x								
C 109	6	Ability to help persons responsible for educational activities or institutions identify and articulate the objectives of the activity or institution.					x			(x)			x
C 110	7	Knowledge of various evaluation models (e.g, Stake, CIPP).					x	x		(x)			x
C 313	8	Ability to identify and articulate an evaluation problem.			x								
C 112	9	Ability to design and conduct interviews for the purpose of collecting data.	x				x			x			x
C 115	10	Ability to incorporate systematic evaluation procedures in plans for developing educational programs.			x								

*Parentheses denote secondary emphasis.

ITEMS CROSS-KEYED WITH TASK CATEGORIES AND RDDE CATEGORIES

Competency # (from Appendix D)	Item #	Item	Task Categories							RDDE Emphasis			
			1	2	3	4	5	6	7	R	D	D	E
C 201	11	Ability to plan data collection procedures appropriate to a research or evaluation activity.			x								
C 202	12	Knowledge of measurement theory and techniques.	x		x		x			x			x
C 204	13	Knowledge of general principles of instrument construction.	x				x			x			x
C 205	14	Knowledge of specific questionnaire construction techniques.					x			(x)*			x
C 205	15	Knowledge of appropriate uses for questionnaires.					x			(x)			x
C 206	16	Ability to construct instruments to assess attitudes and other affective variables.					x			(x)			x
C 207	17	Ability to select appropriate standardized tests or instruments.	x				x			x			x
C 212	18	Ability to write unambiguous items in vocabulary appropriate to the audience.					x			(x)			x
C 218	19	Ability to conduct item analyses, including computation of difficulty and discrimination indices.	x							x			(x)
C 302	20	Knowledge of survey research designs and techniques.			x								
C 303	21	Knowledge of general principles of research design.	x				x			x			x
C 304	22	Knowledge of specific experimental and quasi-experimental designs.	x						x	x			(x)

*Parentheses denote secondary emphasis.

ITEMS CROSS-KEYED WITH TASK CATEGORIES AND RDDE CATEGORIES

Competency # (from Appendix D)	Item #	Item	Task Categories							RDDE Emphasis			
			1	2	3	4	5	6	7	R	D	D	E
C 305	23	Knowledge of factors which jeopardize internal and external validity.	x				x			x			x
C 306	24	Ability to operationalize a research design into specific research procedures.	x	x	x		x		x	x	x		x
C 307	25	Ability to design studies to control extraneous variables.	x				x			x			x
C 309	26	Knowledge of sampling theory and techniques.	x				x			x			x
C 313	27	Ability to identify and articulate a researchable problem.			x								
C 314	28	Ability to formulate testable hypotheses or researchable questions.	x				x			x			x
C 376	29	Knowledge of procedures and steps in developing curriculum materials.		x	x						x		
C 414	30	Knowledge of systems analysis concepts and techniques.			x								
C 421	31	Ability to state objectives in measurable terms.	x	x	x		x	x	x	x	x		x
C 501	32	Knowledge of mass production of curriculum materials (e.g., reproduction and packaging processes).			x								
C 502	33	Knowledge of printing constraints and specifications (e.g., type size).				x				(x)*		x	
C 507	34	Knowledge of design stages in developing audio-visual or multi-media materials.		x	x						x		

*Parentheses denote secondary emphasis.

ITEMS CROSS-KEYED WITH TASK CATEGORIES AND RDDE CATEGORIES

Competency # (from Appendix D)	Item #	Item	Task Categories							RDDE Emphasis			
			1	2	3	4	5	6	7	R	D	D	E
C 541	35	Knowledge of various instructional approaches that might be incorporated into curriculum materials.		x	x						x		
C 609	36	Knowledge of effective proposal-writing techniques.							x				
C 613	37	Ability to identify educational needs.		x	x		x				x		x
C 614	38	Ability to determine what financial resources are necessary to conduct a program or project.			x				x				
C 614	39	Ability to use accounting procedures to operate within a program or project budget.			x				x				
C 615/ C 625	40	Ability to plan and manage day-to-day activities of an on-going program or project.	x	x	x	x	x	x	x	x	x	x	x
C 616	41	Knowledge of management and planning techniques (e.g., PERT, PPBS).			x								
C 617	42	Knowledge of effective techniques of recruiting, interviewing, and hiring personnel.			x								
C 701	43	Knowledge of various formal and informal systems of recording observations of behavior (e.g., Interaction Analysis).			x								
C 702	44	Ability to use formal or informal systems of recording observations of behavior.			x			x					(x)*
C 801	45	Ability to choose appropriate statistical techniques for data analysis.	x				x			x			x

*Parentheses denote secondary emphasis.

ITEMS CROSS-KEYED WITH TASK CATEGORIES AND RDDE CATEGORIES

Competency # (from Appendix D)	Item #	Item	Task Categories							RDDE Emphasis			
			1	2	3	4	5	6	7	R	D	D	E
C 805	46	Knowledge of descriptive statistical techniques (e.g., means, standard deviations).	x							x			(x)*
C 807	47	Knowledge of ANOVA or ANCOVA designs and techniques.	x							x			(x)
C 808	48	Knowledge of correlational techniques.	x							x			(x)
C 810	49	Knowledge of statistical regression techniques.	x							x			(x)
C 811	50	Knowledge of t-tests and critical ratios.	x							x			(x)
C 813	51	Knowledge of instrument reliability, including types of reliability coefficients.	x				x			x			x
C 814	52	Knowledge of instrument validity, including various approaches to determining validity.	x				x			x			x
C 815	53	Knowledge of factor analytic techniques.	x							x			(x)
C 816	54	Knowledge of distribution theory and distributions commonly used in statistics.	x							x			(x)
C 817	55	Knowledge of non-parametric statistical techniques.	x							x			(x)
C 819	56	Knowledge of theoretical assumptions underlying various statistical techniques.	x						x	x			(x)
C 822	57	Knowledge of alternate methods of presenting data (e.g., graphs, tables).	x			x				x		x	(x)
C 826	58	Ability to use standardized ("canned") computer programs (e.g., BMD series).	x				x			x			x

*Parentheses denote secondary emphasis.

ITEMS CROSS-KEYED WITH TASK CATEGORIES AND RDDE CATEGORIES

Competency # (from Appendix D)	Item #	Item	Task Categories							RDDE Emphasis			
			1	2	3	4	5	6	7	R	D	D	E
C 826	59	Ability to design card layouts to allow data analysis within computer constraints.	x				x			x			x
C 827	60	Ability to write computer programs.	x						x	x			(x)*
C 828	61	Knowledge of capabilities of computer systems you use.	x						x	x			(x)
C 832	62	Ability to read and interpret computer output.	x							x			(x)
C 902	63	Ability to lead group discussions, moderate meetings, or facilitate constructive interactions among personnel.			x	x	x	x		(x)		x	x
C 911	64	Ability to use library research techniques (e.g., indices to periodicals).				x				(x)		x	
C 912	65	Ability to use ERIC or other information retrieval systems.				x				(x)		x	
C 108	66	Ability to obtain and use feedback for management purposes in an on-going program or project.		x	x		x	x		(x)	x		x
C 209	67	Knowledge of techniques for assessing student achievement in relation to behavioral outcomes.		x							x		
C 210	68	Knowledge of systems developed to categorize human behavior or abilities (e.g., Bloom's taxonomy).		x							x		
C 312	69	Ability to plan an effective development program or project.		x							x		

*Parentheses denote secondary emphasis.

ITEMS CROSS-KEYED WITH TASK CATEGORIES AND RDDE CATEGORIES

Competency # (from Appendix D)	Item #	Item	Task Categories							RDDE Emphasis			
			1	2	3	4	5	6	7	R	D	D	E
C 366	70	Ability to sequence learning activities to facilitate student learning in curriculum or set of curriculum materials.		x							x		
C 368	71	Ability to use field testing techniques during preliminary tryout or implementation of new curriculum materials.		x							x		
C 508	72	Ability to develop appropriate product specifications for new educational products.		x							x		
C 409	73	Ability to critique a written or oral presentation.	x		x	x	x			x		x	x
C 508	74	Ability to determine when an educational product has been tested sufficiently to warrant dissemination and adoption.		x							x		
C 821	75	Ability to interpret and integrate statistical data into a meaningful presentation.	x			x				x		x	(x)*
C 823	76	Ability to organize and classify information into meaningful categories.				x				(x)		x	
C 913	77	Ability to develop and apply an effective system for summarizing and recording information obtained through a manual search of library sources and references.				x				(x)		x	
C 917	78	Ability to communicate orally in a clear and effective manner.				x				(x)		x	

*Parentheses denote secondary emphasis.

APPENDIX I

TEST OF EDUCATIONAL RESEARCH AND EVALUATION COMPETENCIES: FORMS A AND B

DIRECTIONS FOR TEST OF EDUCATIONAL RESEARCH AND EVALUATION COMPETENCIES: FORMS A AND B

(Directions for use with answer sheet)

Select the best answer to each question and place the letter in the corresponding space on the answer sheet. Be sure to black out completely the letter corresponding to the correct answer.

(Directions for use without answer sheet)

Select the best answer to each question. Circle the letter of the option you choose.

TEST OF EDUCATIONAL RESEARCH AND EVALUATION COMPETENCIES: FORM A

1. Some educational researchers view differences in aptitudes as differences in time needed to learn a task. Which educational practice follows most closely from such a conceptualization?

   A. Providing a rich and varied school curriculum.

   * B. Providing instruction at different rates for different students.

   C. Providing periods of free activity or rest interspersed among periods of learning.

   D. Allowing students to pursue their individual interests.

2-3 Questions 2 and 3 refer to the following problem situation:

An educational experiment consisted of two equivalent groups (x and y) taught by different methods (X and Y). On the basis of a test given at the end of the experiment, method X (which was used with the higher scoring group, x) was, in this instance, judged by the investigators to be superior for developing the kinds of skills required by the test.

For purposes of convenience, let I and II stand for the following verbal statements:

I. "Method X is better than method Y."

II. "Group x scores higher than group y."

2. Which pattern of deductive reasoning has the investigator probably followed in making his conclusion?

   A. Since I is true and since I implies II, II is true.

   B. Since I is NOT true and since I implies II, II is NOT true.

   *C. Since II is true and since I implies II, I is true.

   D. Since II is NOT true and since I implies II, I is NOT true.

---

* correct response

3. Is the following (from #2 above) a valid example of deductive reasoning?

Since I is NOT true and since I implies II, II is NOT true.

A. Yes, it is a valid example.

*B. No, it is not a valid example.

4-9 Questions 4-9 refer to the following lists of descriptions and names. Match each description of area of interest with the name of the scientist who has worked extensively in that area. Mark the letter identifying the scientist's name on your answer sheet after the item number corresponding to the area of interest. No name is used more than once.

Area Of Interest

4. _*B_ Taxonomy of Educational Objectives
5. _*D_ Interaction Analysis System of Classroom Observation
6. _*F_ Semantic Differential
7. _*I_ Evaluation Models
8. _*E_ Factor Analysis
9. _*C_ Sources of internal and external validity

Name

A. Alfred Baldwin
B. Benjamin Bloom
C. Donald Campbell
D. Ned Flanders
E. Henry Kaiser
F. Charles Osgood
G. Jean Piaget
H. M. Rokeach
I. Robert Stake
J. Paul Torrance

10-12 Questions 10-12 refer to the following problem situation:

There are several ways to select a simple random sample, although some are more efficient than others. For each of the following three procedures, MARK A on your answer sheet if it will result in a random sample of 50 persons drawn from a population of 80; MARK B if it will not result in a random sample.

*A 10. Assigning each person 10 numbers as follows: person 1:10-19; person 2:20-29; person 3:30-39; etc.- - then selecting the first 50 persons having at least one of their numbers drawn from a random numbers table.

*B 11. Selecting the person with the next larger number if the person whose number was drawn from a random numbers table has already been selected for the sample.

*A 12. Arranging the 80 persons alphabetically and then selecting the 50 having the positions in the order that match the first 50 different numbers read from a table of random numbers.

13. A naive student constructed a questionnaire to measure the relationship between grade level and library usage. One of the proposed questions was:

How often do you talk in class?
1. always
2. frequently
3. quite a lot
4. about average

Which one of the following is NOT a serious flaw in the student's questions?

A. The four categories are not mutually exclusive.

B. The question appears unrelated to the research problem.

*C. There are only four categories.

D. The words used are not adequately defined.

E. The categories are not exhaustive.

14. A test used to select promising applicants for medical school is "valid" if

*A. Those with higher scores perform better in medical school.

B. Medical school students get higher scores than those in other schools.

C. It eliminates most of those who apply for medical training.

D. Medical students get approximately the same score on the test when taken at two different times (about two weeks apart).

15. Which one of the following practices is considered MOST desirable in the scoring of pupil answers to a series of essay questions in a subject like English literature?

A. See who the pupil is so that you can have a better idea of what the pupil was actually trying to communicate in his answer.

B. Score the answers for the best and worst student first so that the range of possible scores can be estimated.

*C. Score each question for the whole class before going on to the next question so scoring standards can be kept better in mind.

D. Score an answer to the question "as a whole" so that the score does not represent some meaningless total of several part scores.

16. The correlation between the scores on the odd and even numbered items on a test is .46. Of the options given, the most reasonable value of the reliability of the test (as estimated by the split-half technique) is

A. .23

B. .46

* C. .63

D. .92

17. According to evaluation theorists like Robert Stake, which activity is LEAST essential for a sound plan of evaluating an educational program?

A. Obtain information which will be useful in helping to make decisions.

* B. Keep to a bare minimum subjective estimates of program objectives and attainments.

C. Employ a variety of data gathering instruments and measuring techniques.

D. Describe the nature of the educational program and the context in which it is found.

E. Measure several unintended as well as anticipated outcomes.

18-19 Questions 18 and 19 refer to the following problem:

Grade 8 math grades are being used to screen students for 9th grade algebra in Eastern High School. They correlate .48 with algebra 9 grades. Scores from an intelligence test and an algebra aptitude test administered in grade 8 are both being considered as a supplement to grade 8 math grades in the screening process. They show the following correlations:

	Algebra Grades	Grade 8 Math Grades
Intelligence Test	.40	.50
Algebra Aptitude Test	.40	.10

18. Which test would be better to add as a second measure to screen students for 9th grade algebra--assuming only one test could be used?

A. The intelligence test.

* B. The algebra aptitude test.

C. Both tests would be equally useful.

19. Which correlation coefficient(s) may be correctly termed a predictive validity coefficient?

A. Only .40. B. Only .50. C. Only .48.

* D. Both .40 and .48. E. Both .40 and .50.

20. The word "shrinkage" is employed by empirical researchers in a specific way. What shrinks?

A. The credibility of a theory when contrary evidence is presented.

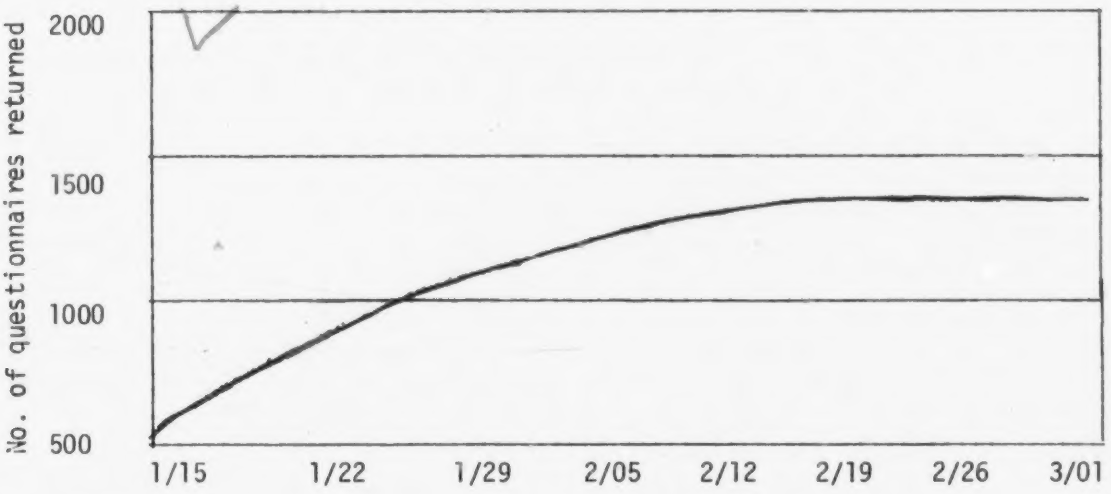
B. The number of cases when subjects drop out of the study, are absent, or in some way fail to provide needed data.

C. Test reliability when the split-half formula is used instead of the test-retest formula.

* D. Multiple correlations when weightings are employed with other samples.

21-25. Questions 21-25 refer to the following paragraph:

"Faced with the necessity of collecting extensive data from 1,452 recent liberal arts graduates dispersed about the globe, this researcher devised a personalized approach. . .(in which). . . individual letters were prepared with the help of computers and signed by college professors close to the students. Using this appeal together with a short follow-up letter, and a third in some cases, a return of ... percent of the ...questionnaires was achieved within two months."



QUESTIONS:

21. About what percent of the questionnaires were eventually returned?

A. 13 B. 31 C. 56 D. 67 * E. 93

22. The figure above represents a cumulative distribution.

* A. True

B. False

23. The variable on the ordinate (vertical axis) is measured at the ratio scale level of measurement.

* A. True

B. False

24. About twice as many returns were received on or before 2/12 than were received on or before 1/22.

A. True

* B. False

C. Not enough information to tell.

25. If the graph above were converted to a histogram showing the number of questionnaires returned each week, the graph would be

A. Negatively skewed

* B. Positively skewed

C. Bimodal

D. Bell shaped

E. Rectangular

26. Which statistical technique usually employs an independent variable which is nominal (categorical) in scale, and a dependent variable which is interval (equal-interval) in scale?

A. Contingency table (cross-break).

* B. Analysis of variance.

C. Friedman test.

D. Multiple regression.

27. Consider the following proposal written by a student.

"This study will attempt to discover how repetition in grammar concepts through the grades affects pupil interest in English... Interest maintained through the grades will be examined via two questionnaires, one given to each English teacher and the other given to a random sample of pupils in grades 5-12... My limitations stem from the results of the interest surveys; their reliability and validity are difficult to assess... A random sample of 15 pupils from each grade level under investigation will comprise my sample."

What source of internal invalidity presents the most serious obstacle to this student in accomplishing her research goal of attributing changes in interest in grammar to the repetition of concepts across the grades?

* A. Maturation
B. Testing
C. Statistical regression
D. Instrumentation
E. Selection

28. Suppose you need to run an experiment in which the experimental (E) treatment (after-school art instruction) requires the permission of parents. What is the best procedure, assuming you are primarily interested in internal validity?

A. Have alternate students standing by to replace any in the E group who are unable to secure permission of their parents.

B. Assign students randomly to E and control (C) groups. Let the students in the E group who couldn't get permission "drop" and assess this loss by throwing out the data for students in the C group who seemed like the "drops" in the relevant variables.

* C. Secure permission from all possible parents before the experiment, and before random assignment of students to treatments.

D. Assume that drop-out is random and disregard such dangers in the analysis.

29. Suppose you have two classes available, both taught by the same teacher, and wish to test the efficacy of a particular visual aid in instruction. For each unit through the semester the aid is assigned randomly to one class or the other. At the end of a semester, student performance in the units taught by visual aid is significantly superior to that in the units taught without. Under which of the following assumptions may you generalize the results to presence of the aid?

* A. No interaction between treatments and any of the specific variables such as teacher or class, etc.

B. The teacher is an average teacher and the classes are average classes.

C. No interaction between maturation and history.

D. The classes, although intact, are essentially equivalent.

30. Consider these two designs:

i. 0 0 0 X 0 0 0

ii. $$\begin{array}{c} \underline{0\ 0\ 0\ X\ 0\ 0\ 0} \\ \hdashline 0\ 0\ 0 \quad\ 0\ 0\ 0 \end{array}$$

An advantage of design ii over design i is that some attempt is made to control

* A. History

B. Selection

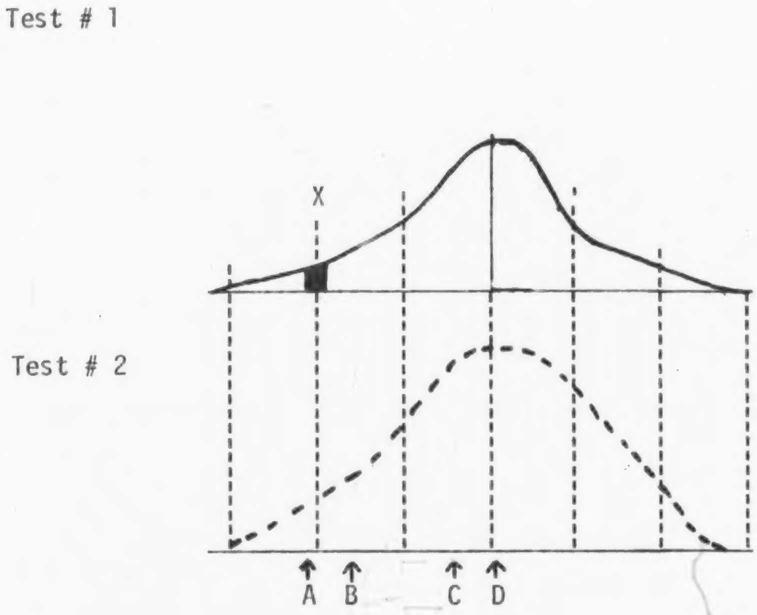
C. Mortality

D. Multiple-X interference

E. Interaction of testing and X

31-33 Questions 31-33 refer to the following paragraph:

Tests 1 and 2 correlate .80. You have Test 1 scores for many thousands of people, and from these people you take 1000, all of whom scored at point X on Test 1 (see diagram below). You now want to predict their performance on Test 2.



A) Point A

B) Point B

C) Point C

D) Point D

*B 31. Which one of the points above do you predict as the average score of the 1000 persons on Test 2?

*A 32. Which of the points above would be predicted for a correlation of 1.00?

*D 33. Which of the points above would be predicted for a correlation of 0.00?

34. Forty-seven high school students responded to a 17-item questionnaire on drugs. For each question the students were asked to check SA (strongly agree), A (agree), U (uncertain), D (disagree) or SD (strongly disagree). The researcher gave 5 points for an SA answer, 4 points for an A answer, 3 points for a U answer, 2 points for a D answer, and 1 point for an SD answer. Which of the following is the most reasonable value for the variance of the item responses to a given question?

* A. .47

B. 4.7

C. 9

D. 17

E. 47

35-37 Questions 35-37 refer to the following data:

Assume the following data were accurately computed for some dependent variable.

Sex	Mean	S.D.	Diff.	t
M	117.4	13.5	1.4	1.75 *
F	118.8	14.7		

* $p < .05$ one tail test

For each of the following statements mark on your answer sheet

A. If the statement is definitely true

B. If the statement is definitely false

C. If you can't tell whether the statement is definitely true or definitely false

*B 35. The correlation between sex and score on the dependent variable is zero.

*A 36. The standard error of the difference between the means is .8.

*B 37. The 95% confidence interval for the true difference between the means is approximately - 1.4 to + 1.4.

38. For a group of examinees, the correlation coefficient between number of items on this test not answered correctly and the total score on this test will be closest to

A. 0

B. .30

C. -.30

D. 1.00

* E. -1.00

39. A researcher used a standardized vocabulary test with a reported (published) split-half reliability of .90. When he calculated the split-half reliability of the test for the 215 Jefferson High School students he used in the experiment, the reliability was only .77. Which of the following is the most likely explanation for the discrepancy?

A. The test did not measure vocabulary ability as well for these students as for the norm population.

* B. The 215 students were more homogeneous in vocabulary ability than the norm population.

C. The norm population is larger in number than 215.

D. An error was made since a discrepancy of this size for such large samples is unreasonable.

40. A researcher has a hypothesis that motivation (M) affects learning (L) only by triggering the aptitude (A) of the child. Which finding would offer the best support for this hypothesis?

A. The correlation between M and L is zero. ($r_{ML} = 0$)

B. The multiple correlation between L and the combination of A and M equals zero. ($R_{L.AM} = 0$)

C. The multiple correlation between L and the combination of M and A is greater than the correlation between L and M. ($R_{L.MA} > r_{LM}$)

* D. The correlation between L and M with A partialled out is equal to zero. ($r_{LM.A} = 0$)

41-42 Questions 41 and 42 refer to the following problem situation:

A questionnaire consisting of 150 items was administered to a group of subjects. The researcher wished to place all the items in the questionnaire into a few scales which met the criterion of statistical homogeneity.

41. The items within such a scale would

A. Have about the same means.

B. Have high standard deviations.

* C. Have relatively high correlations with each other.

D. Be statistically significant at the 5% level.

E. Have about the same item difficulty.

42. The more useful technique in accomplishing this researcher's goal is probably

A. Cross-tabulation analysis.

B. Analysis of variance.

C. Bayesian analysis.

* D. Factor analysis.

E. Nonparametric analysis.

43. A first grade class has 15 black and 15 white children. A researcher intends to select, at random, five different children to participate in an experiment. What is the probability that this selection procedure will produce a sample of all black children?

* A. Less than $(1/2)^5$

B. Exactly $(1/2)^5$

C. More than $(1/2)^5$

D. The value cannot be determined.

44. Matrix V is a "singular" matrix. This means it

A. Is a scalar.

* B. Has no inverse.

C. Is an identity matrix.

D. Not necessarily any of these.

45. Consider the following to be a sequence in a FORTRAN program. What will N be equal to at the end?

```
    N = 0
    DO 20 I = 1, 10
20  N = N + 1
```

A. 0

B. 1

* C. 10

D. 11

E. 20

TEST OF EDUCATIONAL RESEARCH AND EVALUATION COMPETENCIES: FORM B

1. Assume that it is true that measurements of brain activity, rapid eye movement, and muscle activity show specific patterns during dreams which are absent during non-dream periods. In contrast with a researcher who doesn't, a researcher who measures this activity and movement may be able to provide direct, objective evidence about the likely validity of which one of the following hypotheses?

* A. More intelligent children dream more than less intelligent children.

B. Children who have a tension-filled school day will have more unpleasant dreams than children having happy school days.

C. Dreams represent real desires.

D. There is a negative relationship between pleasantness of dreams and accuracy with which the content of dreams is recalled.

2. The reason that "fate caused it to happen" is not used as a scientific explanation is because

A. Researchers don't, as a group, believe in fate.

B. Mystical concepts are excluded from scientific discussion.

* C. Fate can be used to explain why anything happens, and thus fails to explain why this rather than that happens.

D. Fate refers to something which is not observable in the empirical sense.

3-8 Questions 3-8 refer to the following paragraph:

A naive student researcher conducted a study in which he wished to assess the degree of relationship between certain leadership dimensions for principals and their pupils' attitudes toward school. He used a commercially available pupil attitude instrument and constructed his own measures of the leadership dimensions. The study, as conducted, had some undesirable characteristics that would concern an expert researcher as well as some characteristics that would not be of much concern. For each of the six characteristics listed below, indicate whether the feature should be of concern or not. (Note: Three items are keyed A, three B.)

3. The measure of principal leadership style was not pretested.

* A. Undesirable feature.

B. Should not be of concern.

4. Only 10 principals were used.

* A. Undesirable feature.

B. Should not be of concern.

5. The pupil attitude instrument did not have adequate norms.

A. Undesirable feature.

* B. Should not be of concern.

6. The names and attitude responses of pupils were shown to the respective principals.

* A. Undesirable feature.

B. Should not be of concern.

7. No responses from teachers were obtained.

A. Undesirable feature.

* B. Should not be of concern.

8. Commercial and home-made instruments were mixed together in a single study.

A. Undesirable feature.

* B. Should not be of concern.

9-10 Questions 9 and 10 refer to the following paragraph.

An investigator has developed a scale which he hopes is a valid measure of "severe anxiety". He correlates this measure with measures of educational achievement, sex, and degree of inconsistency in child rearing practice. The correlations are -.34, .02, and .56 respectively.

9. The investigator was probably trying to demonstrate

* A. Construct validity.

B. Face validity.

C. Validity by the multi-trait, multi-method procedure.

D. Predictive validity.

[✓ E. Concurrent (status) validity.]

10. For his intent, the findings tend to

* A. Be supportive of the measure's validity.

B. Fail to support the measure's validity.

11. Which one of the following practices would help the most to insure that a researcher obtains reliable ratings of certain traits?

A. Include scales of traits that are independent of each other.

* B. Provide definitions or examples of the points on the scales.

C. Include at least five (7 or 9 preferable) points on each of the scales.

D. Instruct raters to stick with first impressions and to resist changing ratings once made.

12. What is the principal objection to broad, generalized statements of instructional objectives such as "to develop good citizenship?"

A. Such objectives are not as important as the intermediate, more narrowly defined skills.

B. In reality, little instructional effort is directed toward teaching for such objectives.

* C. The evidence that such objectives have been attained is not defined.

D. They are usually taken for granted and tell little about the distinctive characteristics of a school system.

13. Who of the following is not a well-known writer in curriculum evaluation?

* A. Ramsey B. Scriven C. Stufflebeam

D. Tyler

14. For purposes of curriculum evaluation, human judgments

A. Are not usefully quantifiable.

B. May be expected to conform with test evidence.

* C. Can be usefully summarized by available sampling and statistical techniques.

D. Should be gathered mostly from the classroom teachers.

15. In order to obtain a critical appraisal of the Stanford Achievement Test Battery, which one of the following resources is likely to be most helpful?

* A. Mental Measurements Yearbooks

B. Education Index

C. Educational and Psychological Measurement

D. Encyclopedia of Educational Research

E. Tests In Print

16. A student receives a test score of 58. Which one of the following would give you the most information concerning how many points this student's score is likely to differ from his "true" score?

* A. The standard error of measurement of the test.

  B. The reliability of the test.

  C. The standard deviation of the test scores.

  D. The validity of the test.

  E. The z score (or T score) equivalent of a test score of 58.

17. Most of our test predictions of school success are based on correlations of about

  A. .00

  B. .20

* C. .50

  D. .80

18-19 Questions 18 and 19 refer to the following paragraph:

You wish to predict an adolescent's success in engineering. He takes two tests that are called "aptitude" tests to find out whether he has an "aptitude" for engineering. On Test #1 he scores a z score of +2.00. On Test #2 he scores a z score of -1.50. You find that both tests are correlated with engineering success but the correlations are different. Test #1 correlates with engineering success .15, while Test #2 has a correlation with success of .75.

18. In making your prediction about the adolescent's future success in engineering, you should

  A. Consider both tests of almost equal merit.

* B. Practically ignore Test #1.

  C. Practically ignore Test #2.

19. On the basis of the evidence presented above, you would predict that the adolescent would probably

* A. Do poorly in engineering.

  B. Do about average in engineering.

  C. Do well in engineering.

  D. It would be impossible to say because of conflicting test results.

20. Suppose you want to study the effect of treatment x on a single trait measured by different tests O_A and O_B. Here are 5 possible designs. (E and C represent experimental and control groups respectively.)

I. E: X O_A
C: O_A

II: E: O_A X O_B
C: O_A O_B

III. E: O_A X O_A
C: O_B O_B

IV: E: O_A O_B
C: O_B X O_A

V. E: O_A X O_B
C: O_B O_A

Which design is best if subjects were NOT randomly assigned to the experimental and control groups?

A. Design I
* B. Design II
C. Design III
D. Design IV
E. Design V

21. Annual achievement tests, illness records daily assignments, and other routine characteristics and activities of the school are considered for experimental purposes.

A. Reactive.
* B. Nonreactive.

22. In classroom experiments where achievement in a subject is the criterion, which solution best answers the problem of biased assignment and unique intragroup histories?

* A. Moving the randomization to classrooms as units.
B. Setting up randomization procedures to assign students to classes at the beginning of fall semester.
C. Applying analysis of covariance to individual student ability.
D. Use of the within-class variance as error term.

23-25. Questions 23-25 refer to the following problem situation:

Six students, three first graders and three second graders, are each administered a test twice, once after exposure to a control treatment and once after exposure to an experimental treatment. Let G represent grade; S, student; T, treatment; and X, test score.

A.

		T_1	T_2
G_1	S_1	x	x
	S_2	x	x
	S_3	x	x
G_2	S_4	x	x
	S_5	x	x
	S_6	x	x

B.

	T_1		T_2	
	G_1	G_2	G_1	G_2
S_1	x	x	x	x
S_2	x	x	x	x
S_3	x	x	x	x

C.

	G_1			G_2		
	S_1	S_2	S_3	S_4	S_5	S_6
T_1	x	x	x	x	x	x
T_2	x	x	x	x	x	x

D.

T_1						T_2					
G_1			G_2			G_1			G_2		
S_1	S_2	S_3	S_4	S_5	S_6	S_1	S_2	S_3	S_4	S_5	S_6
x	x	x	x	x	x	x	x	x	x	x	x

23. Which diagram is NOT an accurate portrayal of the research design?

A. Diagram A	C. Diagram C
* B. Diagram B	D. Diagram D

24. Which one of the following does NOT accurately describe a characteristic of the design as described verbally above?

A. Treatment is crossed with grade.

B. Treatment is crossed with student.

C. Student is nested within grade

* D. Grade is nested within treatment.

25. These data would probably be analyzed by using

A. An analysis of covariance model.

B. A fixed effects analysis of variance model.

* C. A repeated measures analysis of variance model.

D. A random effects analysis of variance model.

E. A non-linear analysis of variance model.

26. What is the median of the following numbers: 9, 2, 1, 9, 4?

A. 1 * B. 4 C. 5 D. 9

27-29 Questions 27-29 refer to the following problem:

A test has a mean of 100 and a standard deviation of 16. Joe scored 84 on this test.

27. What is Joe's score in z score units?

A. + 16.00   B. + 1.00   * C. - 1.00   D. - 16.00

28. What is Joe's score in T-score units?

A. 85   B. 65   C. 50   *D. 40

29. Assuming the test score distribution is normal, what percentage of the population will have scores lower than Joe's?

A. 2%   B. 5%   * C. 16%   D. 35%

30-32 Questions 30-32 refer to the following paragraph:

Suppose that a 30-minute test of reading speed and a 30-minute test of comprehension appropriate for use in grades 7-9 have been given to 100 children from grade 8 only, and the correlation between these two tests has been found to be r = .60.

30. If there had been 300 children in the sample instead of 100, but still of the same type, grade and age we should expect that the correlation would be

A. Larger than .60.

B. Smaller than .60.

C. Precisely .60.

* D. Near .60, perhaps a little larger or a little smaller.

31. If the tests described in the preceding question had been given to 100 children from grades 7, 8 and 9, we should expect that the correlation would be

- * A. Larger than .60.
- B. Smaller than .60.
- C. Precisely .60.
- D. Near .60, perhaps a little larger or a little smaller.

32. If the tests described above were reduced in length by eliminating about half of the questions at random, we should expect the correlation between the shortened forms to be

- A. Larger than .60.
- * B. Smaller than .60.
- C. Precisely .60.
- D. Near .60, perhaps a little larger or a little smaller.

33. Assuming that σ_x and σ_y are constant, as a correlation increases from .0 to 1.00, the standard error of estimate

- A. Increases also.
- B. Remains approximately the same size.
- * C. Decreases.
- D. Impossible to say.

34. A class of 30 entering kindergarten students were asked individually to do two things: name the color of a brown circle and pick a triangle from a number of shapes. Twenty children could name the color, 15 could pick out the triangle, and 12 children could do both. The relationship between whether or not children are able to name "brown" and whether or not they are able to pick out the triangle could most appropriately be shown by computing which correlation coefficient?

- A. Eta
- B. Point biserial
- * C. Phi
- D. Kendall's tau
- E. Spearman's rho

35-36 Questions 35 and 36 refer to the following set of figures:

Shown below are four possible ways in which two predictors, P_1 and P_2, could correlate with each other and with a criterion variable C.

(A)

$$\begin{array}{c|ccc} & P1 & P2 & C \\ \hline P1 & 1 & .5 & .5 \\ P2 & & 1 & .5 \\ C & & & 1 \end{array}$$

(B)

$$\begin{array}{c|ccc} & P1 & P2 & C \\ \hline P1 & 1 & .0 & .5 \\ P2 & & 1 & .5 \\ C & & & 1 \end{array}$$

(C)

$$\begin{array}{c|ccc} & P1 & P2 & C \\ \hline P1 & 1 & .0 & .0 \\ P2 & & 1 & .5 \\ C & & & 1 \end{array}$$

(D)

$$\begin{array}{c|ccc} & P1 & P2 & C \\ \hline P1 & 1 & .5 & .5 \\ P2 & & 1 & .0 \\ C & & & 1 \end{array}$$

35. Which martrix, used in multiple regression, will best predict the criterion?

A. A
* B. B
C. C
D. D

36. Which of the matrices above best exhibits what is called a "suppressor variable?"

A. A
B. B
C. C
* D. D

37. In a principal-components factor analysis, the correlation of a test with a factor is called

A. Communality.
* B. Loading.
C. Centroid.
D. Rotation.

38. A researcher seeks to compare the effect of two different counseling treatments, T_1 and T_2. As each counselee is to begin treatment, an unbiased coin is flipped to determine whether to use T_1 (a head appears) or T_2 (a tail appears). Suppose the last three counselees were all assigned to T_2 (because tails appeared in each case). The probability that the next student will also be assigned to the T_2 treatment is

A. Somewhat less than that of being assigned to the T_1 procedure.

* B. Exactly the same as that of being assigned to the T_1 procedure.

C. Somewhat more than that of being assigned to the T_1 procedure.

D. One in sixteen.

E. Not determinable.

39. If the difference in means of an experimental and a control group is statistically significant at the 5% level, one may conclude that the

* A. Odds are at least 19 to 1 against such a difference arising from sampling error under a true null hypothesis.

B. Mean difference was at least 20 times as large as the standard deviation.

C. Power of the statistical test was .95.

D. Probability that the null hypothesis was true was at least .95.

E. Experimental treatment was much more effective than the control as measured by the dependent variable.

40. In testing for the significance of the difference between two means, an investigator failed to use the formula which takes into account the fact that both means were obtained from the same sample of 85 persons. Repetitions of this error will cause the investigator to

* A. Announce too few significant results.

B. Announce too many significant results.

C. Reject too many true null hypotheses.

D. Underestimate the standard error of the difference between means.

E. More than one of the above.

41-42 Questions 41 and 42 refer to the following problem situation:

The following table shows the mean scores on a test of "fate control" for four large and equal sized groups of black and white pupils in two grades. A high "fate control" score means belief that most events are caused by fate. Data are hypothetical.

		GRADE	
		4th	8th
RACE:	Black	14.7	6.1
	White	10.5	6.0

41. Which of the following conclusions can be correctly drawn from the table?

A. More education is responsible for people believing less in the importance of fate.

B. The effects of race and grade are additive (in a negative sense).

C. Fourth graders believe fate is roughly twice as important as eighth graders do.

* D. Grade and race interact in a statistical sense in relation to "fate control" measures.

42. Which statistical technique is most appropriate for analyzing data available from such a study?

A. t test.

B. Chi-square test.

* C. Analysis of variance.

D. Factor analysis.

E. Phi correlation coefficient.

43. Consider the following FORTRAN expression:

```
Z = X ** Y * 1/Y.
```

If X = 3 and Y = 2 what does Z equal?

A. 3.0
* B. 4.5
C. 6.0
D. 6.5

44. You are given two simple matrices:

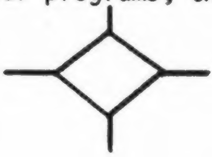
$$S = \begin{bmatrix} 2 & 3 \\ 4 & 1 \end{bmatrix}$$

$$T = \begin{bmatrix} 6 & 2 \\ 9 & 3 \end{bmatrix}$$

A third matrix X = S · T. What is the value of X (1,1)?

A. 12 B. 18 * C. 39 D. 75

45. In flow-charting for computer programs, the symbol



usually means

A. Input. B. Output. C. Operation. * D. Decision

APPENDIX J

TEST OF EDUCATIONAL DEVELOPMENT COMPETENCIES

PART II. THE DEVELOPMENT PROCESS

Directions

This part of the examination consists of 34 items. The first 18 items relate to two brief descriptions of segments in the product development process. Each description is followed by nine statements, some of which are correct. You are to read each description, then on the answer sheet which has been provided, mark an A for each statement which is correct and a B for each statement which is incorrect. If insufficient information has been presented for you to judge the correctness of a statement, then leave the item blank.

Generally speaking, certain incidents in the development of instructional products are recounted in the fictitious descriptions. Your task is to identify correct procedures which were employed or errors which were made by the product developers. No attempt has been made to be devious in the examination. You need not "read between the lines" in order to judge the correctness of the statements. The answers should be apparent to you if you are familiar with appropriate steps in the product development process. Be sure to use the answer sheet for your responses. Now commence with the first description and its accompanying nine statements.

Exercise One

It is mid-December and Frieda, a regional laboratory employee, has been given the responsibility of developing a short self-instruction program to teach sixth grade pupils how to use commas. She has received a set of five explicit instructional objectives from the individuals who originally formulated the project. Along with these objectives there are samples of a single prototype test item for each objective. Frieda has been told that the instructional product is to take no more than four hours of the average learner's time.

The first thing she does is to develop a 40-item criterion test to be used at the close of the program. She has each of the five objectives represented by at least five test items, although two objectives which she feels to be more important are represented by 10 items.

Frieda carefully considers the enroute (intermediate) behaviors which the learner must master on his way to the criterion behaviors and then sequences these from least to most difficult, ending with behaviors like those called for in the instructional objectives. She then prepares practice sequences for each of the enroute and terminal behaviors so that the learner will be able to practice using commas in a variety of situations. After having four colleagues react to her first version of the instructional product, she makes a number of revisions.

Frieda then arranges to field test the program in the public schools and secures the cooperation of a nearby elementary school. She arranges to use three classes for approximately one week and administers the program in early February. At its conclusion the 40-item criterion test is given to each of the 136 children who completed the program.

Frieda is pleased that all youngsters were able to finish the instructional product in three hours or less. She is somewhat concerned, however, that the average score on her 40-item test is only 21.2 correct. She resolves to study the post-test results as well as the responses made by pupils during the program and to make the revisions which seem dictated by the data.

1 - 9 For items 1 through 9 mark A if the statement is correct; mark B if it is incorrect.

*A 1. Frieda was probably correct in providing practice behaviors for the learner which were like those called for in the instructional objectives.

*B 2. She should have required at least two prototype test items along with the instructional objectives.

*B 3. Each objective should have been represented equally on the criterion test.

*A 4. Frieda field-tested her first version of the product on too many learners.

*A 5. She should have pre-tested the subjects.

*B 6. Too much time (mid-December to early February) was taken to complete the first version of the product.

*B 7. Five objectives are too many for such a program.

*B 8. More than four colleagues should have reacted to the first version of the program.

*A 9. Frieda should probably have been concerned that the mean score was 21.2.

Exercise Two

Mr. Smith has been assigned the task of developing a one-week (approximately five 50-minute periods) group-paced instructional program designed to teach high school chemistry students to treat correctly certain analytic equations and problems involving unknown chemical elements. Mr. Smith does not attend to the formulation process because this has been done by others. His responsibility is to develop the actual instructional material. The instructional objective which has been given to him by members of the formulation team is the following:

* Correct response

At the conclusion of the instruction at least 80 percent of the learners will be able to solve seven of ten equation problems involving an unknown compound.

Mr. Smith arranges to talk to several high school chemistry instructors and a half a dozen high school chemistry students to secure some ideas as to the proper tactics to employ in teaching the particular subject. The students are asked how much they already know of the topic so that Mr. Smith can identify the competencies he can build upon when preparing the instructional sequence.

He develops four programs, each lasting approximately 40 minutes, with the expectation that these early versions will be revised and augmented. He adopts a "lean" strategy in programming in which he offers the minimum amount of instructional materials that he believes is requisite, anticipating that if the program fails it will be easier to add to it than to subtract superfluous material from an effective program sequence. All of the programmed material is transferred to an audiotape so that it can be coordinated with visual materials which are presented on 2 x 2 slides. He ultimately plans to transfer the visual sections to a filmstrip, but believes the slide presentation will offer more flexibility for the subsequent addition or deletion of modified visuals.

He next develops a criterion test consisting of thirty items in which the student is presented with verbal descriptions of chemical interactions and asked to describe with chemical equations the nature of the quantitative equations which have been verbally described.

He tries the program with four learners who answer, respectively, 21, 25, 26, and 27 items correctly on the 30-item test.

10-18 For items 10 through 18, mark A if the statement is correct; mark B if it is incorrect.

*A 10. Mr. Smith's expectation that the early version of the program will be revised is realistic.

*B 11. His students did not perform as well as they should have on his first draft materials.

*B 12. A "lean" programming strategy has previously been demonstrated to be ineffectual in this type of task.

*A 13. Mr. Smith should have prepared his criterion test prior to the development of his first version instructional product.

*B 14. The use of audiotape and filmstrip is inconsistent with the notion of group-paced programs.

*A 15. Mr. Smith's criterion test was not appropriate for the instructional objectives he had been given.

*B 16. Mr. Smith, or any similar programmer, has no responsibility for evaluating the adequacy of the formulation operation because of the late point at which he was introduced to the development process.

*B 17. Mr. Smith should not have consulted teachers and pupils prior to the development of his first draft of instructional materials.

*B 18. Mr. Smith should have developed first draft materials which were exactly as long as those meant for the program.

---

19. Which one of the following is LEAST defensible as a component of an instructional program designed to produce mastery on the objective: "To construct an equilateral triangle, given a straight edge and compass"?

A. Checks whether the learner has the prerequisite knowledge of what a triangle is by having the learner identify a triangle given pictures of triangles, rectangles, and other geometric shapes.

B. Provides the definition that an equilateral triangle is a triangle in which all sides and angles are equal.

* C. Asks the learner to name an object that has equal sides and angles.

D. Provides practice in the correct use of a compass.

20. Which one of the following objectives depends most heavily on a higher level cognitive process.

A. Exhibits tolerance for others by displaying good manners toward those of minority groups.

B. Correctly recites the Gettysburg Address from memory.

C. Displays interest in higher mathematics by volitionally attending lectures on this topic.

D. Plays table tennis according to rules well enough to beat three inexperienced girls 10% of the time.

* E. Is able to choose the best of two solutions to a geometry problem using standards given by the teacher.

21. In the following list, identify the one objective which makes most clear what would count as evidence that the objective has been met.

A. The student will know six verbs.

B. The student will learn the names of the common tools in wood shop.

C. The student will prefer cooking to sewing.

* D. The student will be able to thread correctly a sewing machine.

E. The student will pay attention as the teacher demonstrates the use of the lathe.

22-23 Questions 22 and 23 refer to the following paragraph:

An important skill of the product developer is the ability to write test items which match objectives. Such components of items as directions to the learner, content dealt with in the item, and response called for on the part of the learner should be consistent with the instructional objective. For questions 22 and 23 below, indicate whether or not the objective and item match.

22. Objective: The student will write the course of action most consistent with the tenets of good citizenship outlined in class when given a social problem not previously encountered.

Item: Choose a social problem you are familiar with and in less than 300 written words describe how you would deal with it in terms of the citizen concepts described in class.

The objective and item

A. Match

* B. Do not match

23. Objective: The student will be able to arrange in chronological order sets of three historical events identified only by brief descriptive phrases.

Item: Put in the appropriate order of their occurrence the three historical events alluded to in the following phrases:

1. Undeclared U.S. war, often referred to as "police action."
2. Establishment of post World War II treaty organization in Southeast Asia.
3. Final battle signaling end of major French influence in Indo-China.

The objective and item

* A. Match

B. Do not match

Exercise Three

Professor X is helping with a teacher training program. He has been asked to use films to attain some of the objectives of the program. He took the following series of steps:

1. He found a black and white film showing an argument between two boys in the school cafeteria, culminating in a fist fight. The narration described the past history of ill will between these two boys.
2. He took as his lesson objective, "How to deal with aggressive behavior in children."
3. He prepared a printed handout listing "Causes of aggression in children."
4. He showed the film to his teacher trainees.
5. He conducted a discussion of the film and reviewed the printed handout.
6. He gave a test asking the trainees to describe at least 3 instances of aggressive behavior in children they had observed.

Please answer the following questions about the situation described above.

24. Professor X should have

A. Selected a color film instead of a black and white film.

B. Reviewed the handout with the trainees before he showed the film.

* C. Chosen his objective before he chose his film.

D. Asked for at least 5 instances on his test, rather than 3.

25. The major fault with the test given is that

A. It is too short to be reliable.

B. It is difficult to score.

C. It is unrelated to the film.

* D. It is unrelated to the objective.

26. The actions of Professor X violated which important principle in the design of instruction?

A. The materials should be selected first.

* B. The objective should be selected first.

C. The test items should be selected first.

D. The class activity should be selected first.

27. In your judgment, was Professor X least proficient in

* A. Overall planning of instruction.

B. Text construction.

C. Preparing handout materials.

D. Classroom use of films.

28. What reference would you recommend Professor X should read?

* A. Mager's poem on "where am I going, how will I get there, and how will I know I've arrived?"

B. Any good statistics book.

C. A book on making films.

D. Hilgard's Theories of Learning.

29. Suppose you are developing some instructional materials to teach a group of illiterate itinerant farm workers how to use knowledge of the law to stay out of trouble. What would be the best opening strategy?

A. Explain how the law protects us.

B. Give a description of the basic organization of our courts.

C. Ask them what they think "law" means.

* D. Ask "Why is Joe in jail today?"

Exercise Four

Goals and objectives need to be specified at different levels for different purposes. But there is a question of who should be most influential in setting goals at these different levels. Please match types of persons below with the goal level at which they should be most influential.

30. * D General goals of a school
31. * C Objectives for a single course
32. * B Kinds of programs designed to reach the school's goals
33. * A The enabling objectives needed to attain course objectives in a single course

A. Instructional technologist
B. School administrators
C. Teachers
D. Community members

Exercise Five

Many different authors have published "models" of instructional design. Some are labelled as "systems" models, and some are not. The following are steps which may or may not appear in a "systems" model.

1. Pre-testing for entrance competencies.
2. Arranging for "branching" programs.
3. Analytical theory of media selection.
4. Statement of objectives.
5. Elaborate tests at 5 or 6 "levels" in the course.
6. Individualized self-paced method.
7. Set of instructional materials.
8. Hierarchical analysis of objectives.
9. Tests to assess attainment of objectives.
10. Careful balance or "mix" of media.
11. Self-evaluation exercises.
12. Emphasis upon learning by discovery.

34. Which three of the above steps in instructional design will most often appear in a "systems" model?

A. 1, 5, 12

* B. 4, 7, 9

C. 3, 6, 8

D. 4, 6, 10

APPENDIX K

KEY TO COMPETENCIES MEASURED IN EACH TEST ITEM

Test of Educational Research and Evaluation Competencies: Form A*

Final Pilot Test Item Number	Item Number on 137-Item Tryout Test	General Competency Category	Specific Competency Category
1	1	R	R1[a]
2	21	R	R9
3	22	R - E	G1
4	116	R - E	M1, (M4)[b]
5	117	R - E	M1, (M6)
6	118	R - E	M1, (M5)
7	119	R - E	G2
8	120	R - E	P1, (P7)
9	121	R - E	D1
10	5	R, (R - E)	R3, (D2)
11	6	R, (R - E)	R3, (D2)
12	8	R, (R - E)	R3, (D2)
13	10	R, E	R5, E3
14	11	R	R6
15	122	R - E	M4, (M6)
16	108	R - E	P2
17	97	E	--[c]
18	109	R - E	P4, S1, (S5)
19	110	R - E	P3
20	111	R - E	S1, (P3)
21	74	R, (R - E)	R9, (S1)
22	75	R - E	S1
23	76	R - E	M2
24	77	R, (R - E)	R9, (S1)
25	78	R - E	S1
26	88	R - E	S5
27	26	R, R - E	R4, D3

[a] Descriptions of the skills and knowledge are given in the early pages of Chapter IV.

[b] Parentheses denote secondary emphasis.

[c] This item could not be classified more specifically than as a general evaluation skill.

*The matching of items with competencies, as shown in this appendix, is based on logical rather than empirical grounds.

Test of Educational Research and Evaluation Competencies: Form A (continued)

Final Pilot Test Item Number	Item Number on 137-Item Tryout Test	General Competency Category	Specific Competency Category
28	30	R, R - E	R4, D3
29	37	R - E	D3, (D2)
30	27	R, R - E	R4, D3
31	--[d]	R - E	S1, (S5)
32	79	R - E	S1, (S5)
33	80	R - E	S1, (S5)
34	45	R - E	S1
35	57	R - E	S1
36	58	R - E	P2
37	59	R - E	S4
38	42	R - E	S1
39	73	R - E	P3, (P8)
40	13	R	R8, R9
41	113	R - E	P3
42	114	R - E	P5
43	65	R - E	S2
44	90	R - E	P6
45	135	R - E	G3

[d] Through a typographical error, this item failed to be numbered on the tryout test.

Test of Educational Research and Evaluation Competencies: Form B

Final Pilot Test Item Number	Item Number on 137-Item Tryout Test	General Competency Category	Specific Competency Category
1	3	R	R2
2	125	(R - E)	(M6)
3	126	R - E	D3
4	127	R, (R - E)	R5, R6, R7, (M5)
5	128	R - E	D3
6	129	R - E	D3
7	130	(R - E)	(D3)
8	23	R - E	P3
9	24	R	R6, (R9)
10	134	R - E	G1
11	124	R - E	M6
12	98	E	E1
13	99	R - E	G2
14	100	E	E2, (E3)
15	115	R - E	M1
16	107	R - E	P2
17	25	R - E	S1
18	131	R - E	S1, (S5, P3)
19	132	R - E, (R)	S1, (S5, P3, R9)
20	31	R, R - E	R4, D3
21	36	R - E	D3
22	39	R - E	D3, (D2)
23	32	R - E	D4
24	33	R - E	D4
25	34	R - E, (R)	D5, (R8)
26	new item	R - E	S1
27	81	R - E	M3
28	82	R - E	M3
29	83	R - E	M3, (S3)

Test of Educational Research and Evaluation Competencies: Form B (continued)

Final Pilot Test Item Number	Item Number on 137-Item Tryout Test	General Competency Category	Specific Competency Category
30	48	R - E	S1
31	49	R - E	S1
32	50	R - E	P2
33	87	R - E	S1
34	12	R, R - E	R8, S1
35	92	R - E	S1, (S5)
36	93	R - E	S1, (S5)
37	94	R - E	P6, (P5)
38	64	R - E	S2
39	72	R - E, (R)	S4, (R9)
40	66	R - E	S6
41	14	R	R9
42	15	R, E	R8, E4
43	new item	R - E	G3
44	91	(R - E)	(P6)
45	136	R - E	G3

APPENDIX L

QUESTIONNAIRE RECIPIENTS FOR RESEARCH TRAINING STUDY

State Departments of Education

Alabama
* Alaska
* Arizona
* Arkansas
California
Colorado
Connecticut
Delaware
Florida
* Georgia
* Hawaii
* Idaho
Illinois
Indiana
* Iowa
* Kansas
Kentucky
Louisiana
* Maine
* Maryland
Massachusetts
Michigan
Minnesota
* Mississippi
* Missouri
Montana
Nebraska
Nevada
* New Hampshire
New Jersey
* New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
* Puerto Rico
Rhode Island
South Carolina
South Dakota
Tennessee
Texas
Utah
Vermont
Virginia
* Virgin Islands
Washington
West Virginia
Wisconsin
Wyoming
District of Columbia

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*On the basis of their replies to the initial letter of inquiry, starred organizations were not sent copies of the questionnaire for non-degree granting institutions, since they had indicated that they offer no RDDE training activities.

USOE-Supported R&D Centers and Regional Educational Laboratories

R&D Centers

Center for the Advanced Study of Educational Administration, Eugene
Center for Research and Development in Higher Education, Berkeley
Center for the Study of Evaluation, Los Angeles
Center for the Study of Social Organization of Schools, Baltimore
Learning Research and Development Center, Pittsburgh
Research and Development Center for Teacher Education, Austin
Stanford Center for Research and Development in Teaching, Palo Alto
Wisconsin Research and Development Center, Madison

Regional Educational Laboratories

Appalachia Educational Laboratory, Inc., Charleston, W. Virginia
CEMREL, Inc., St. Ann, Missouri
Center for Urban Education, New York
Far West Laboratory for Educational Research and Development, Berkeley
Mid-continent Regional Educational Laboratory, Kansas City, Missouri
Northwest Regional Educational Laboratory, Portland
National Laboratory for Higher Education, Durham, N. Carolina
Research for Better Schools, Inc., Philadelphia
Southwest Cooperative Educational Laboratory, Albuquerque
Southwest Educational Development Laboratory, Austin
Southwest Regional Laboratory, Inglewood, California

Regional Education and School Study Councils

Adirondack Center for Research, Experimentation and Services (ACRES), Plattsburgh, New York

Anne Tyskling Consortium for the Mid-west, Chicago, Illinois

Anthracite Institute for Developing Schools, Wilkes-Barre, Pennsylvania

Arkansas School Study Council, Fayetteville, Arkansas

Associated Public School Systems, New York, New York

Bay Area School Study Council, Palo Alto, California

Bureau of Educational Research, Urbana, Illinois

Bureau of Educational Research and Service, Tucson, Arizona

Bureau of Educational Research and Services, Tempe, Arizona

Capital Area School Development Association, Albany, New York

Catskill Area School Study Council, Oneonta, New York

Central Illinois School Development Council, Normal, Illinois

Central New York School Study Council, Syracuse, New York

Central Ohio Educational Research Council, Columbus, Ohio

Central School Boards Committee for Educational Research, New York, New York

Colgate School Study Council, Hamilton, New York

Connecticut Association for the Advancement of School Administration, Inc., Hartford, Connecticut

Cooperative School Service Center, Amherst, Massachusetts

Cooperative School Study Council, Sacramento, California

Division of Research and Guidance, Los Angeles, California

East Central Indiana School Study Council Joint Program, Muncie, Indiana

East Texas School Study Council, Commerce, Texas

Educational Administration Center, Dekalb, Illinois

Educational Improvement Center, Glassboro, New Jersey

Educational Research and Development Council, Minneapolis, Minnesota

Educational Research and Development Council of Delaware, Inc., Newark, Delaware

Educational Research and Service Bureau, Philadelphia, Pennsylvania

Educational Research Council of America, Cleveland, Ohio

Education Council for School Research and Development, Mineola, New York

ERDC of Central Minnesota, St. Cloud, Minnesota

ERDC of Northeast Minnesota (RAND), Duluth, Minnesota

ERDC of Northwest Minnesota, Red Lake Falls, Minnesota

ERDC of Southwest and West Central Minnesota, Marshall, Minnesota

Florida Educational Research and Development Council, Inc., Gainesville, Florida

Fox Valley Curriculum Study Council, Oshkosh, Wisconsin

Genesee Valley School Development Association, Rochester, New York

Gulf School Research Development Association, Houston, Texas

Idaho State University, Pocatello, Idaho

Indiana Public School Study Council Joint Program, Muncie, Indiana

Indiana State University Educational Development Council, Terre Haute, Indiana

Institute for Educational Research, Downers Grove, Illinois

Iowa Center for Research in School Administration, Iowa City, Iowa

Kansas City Metropolitan School Study Group, Kansas City, Missouri

Lakeshore Curriculum Study Council, Milwaukee, Wisconsin

Lehigh Valley School Study Council, Bethlehem, Pennsylvania

Metropolitan Detroit Bureau of School Studies, Detroit, Michigan

Metropolitan School Study Council, New York, New York

Michigan Educational Research Association, East Lansing, Michigan

Mid-Hudson School Study Council, New Paltz, New York

Mid-Monmouth Educational Council, Long Branch, New Jersey

New England School Development Council, Newton, Massachusetts

New Jersey School Development Council, New Brunswick, New Jersey

New Jersey Urban Schools Development Council, Trenton, New Jersey

New Mexico Research and Study Council, Albuquerque, New Mexico

North Country School Study Council, Potsdam, New York

Northeastern Indiana School Study Council Joint Program, Muncie, Indiana

Northern Illinois Cooperative in Education (NICE), Dekalb, Illinois

Northwest Indiana Public School Study Council Joint Program, Muncie, Indiana

Oklahoma Public School Research Council, Stillwater, Oklahoma

Oregon School Study Council, Eugene, Oregon

Oswego Area Council for Educational Development, Oswego, New York

Peninsula Study Council, Palo Alto, California

Pennsylvania School Study Council, Inc., University Park, Pennsylvania

Philadelphia Suburban School Study Council, Philadelphia, Pennsylvania

Public Schools for Cooperative Research, Knoxville, Tennessee

Rocky Mountain School Study Council, Denver, Colorado

School Information and Research Service, Seattle, Washington

SCOPE, Long Island, New York

Southeast Alabama Superintendents and Principals Conference, Troy, Alabama

Southern Minnesota Educational Research and Development Council, Rochester, Minnesota

Southern Tier School Study Council, Alfred, New York

South Florida Educational Planning Council, Tampa, Florida

S. W. New York Association for the Improvement of Instruction, Fredonia, New York

Southwestern Ohio Educational Research Council, Inc., Middletown, Ohio

Tri-State Area School Study Council, Pittsburgh, Pennsylvania

University of Virginia Council for Educational Research, Charlottesville, Virginia

Upper Wabash Valley School Study Council Joint Program, Muncie, Indiana

Washington Area School Study Council, La Plata, Maryland

Western Educational Council of South Dakota, Ellsworth Air Force Base, South Dakota

Western New York School Development Council, Buffalo, New York

West Texas School Study Council, Lubbock, Texas

Wyoming School Study Council, Laramie, Wyoming

Professional Associations

American College Testing Program, Inc., Iowa City, Iowa

* American Council on Education, Washington, D. C.

* American Personnel and Guidance Association, Washington, D. C.

* American Psychological Association, Washington, D. C.

* American Sociological Association, Washington, D. C.

Association for Supervision and Curriculum Development, Washington, D. C.

College Entrance Examination Board, New York, New York

* National Academy of Sciences, National Research Council, Washington, D. C.

* National Council on Measurement in Education, East Lansing, Michigan

* National Society for the Study of Education, Chicago, Illinois

* Union for Research and Experimentation in Higher Education, Yellow Springs, Ohio

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*On the basis of their replies to the initial letter of inquiry, starred organizations were not sent copies of the questionnaire for non-degree granting institutions, since they had indicated that they offer no RDDE training activities.

Federal Agencies and Offices

Center for Urban Education, New York

Division of State Agency Cooperation, USOE

Educational Communication Office, USOE

Educational Leadership Branch, Bureau of Education Personnel Development, USOE

Educational Staff Seminar, Washington, D. C.

Employee Development Program, USOE

TTT Program, Bureau of Education Personnel Development, USOE

Washington Internships in Education, Washington, D. C.

Private Research and Development Organizations

Academy for Educational Development, Inc., New York, New York
American Institutes for Research, Palo Alto, California
Associates for Research, Inc., Philadelphia, Pennsylvania
Behavioral and Social Sciences Laboratory, Philadelphia, Pennsylvania
Borg-Warner Educational Systems, Niles, Illinois
Columbia Scientific Industries Corporation, Austin, Texas
Education and Training Consultants Co., Los Angeles, California
Education and World Affairs, New York, New York
Educational Development Corporation, Palo Alto, California
Educational Materials and Equipment Company, Bronxville, New York
Educational Testing Service, Princeton, New Jersey
Galton Institute, Beverly Hills, California
General Systems Industries, Inc., Torrance, California
Gould Scientific, Washington, D. C.
* Human Resources Research Organization, Alexandria, Virginia
Institute for Community Studies, Kansas City, Missouri
KDI Corporation, Forera Corporation, Washington, D. C.
KMS Industries, Inc., Electronic Futures Division, North Haven, Connecticut
Lester Associates, Inc., Thornwood, New York
Life Sciences, Inc., Fort Worth, Texas
Thomas A. Edison Industries Laboratory, West Orange, New Jersey
The Mitre Corporation, Bedford Operations, Bedford, Massachusetts
New England Research, Inc., Worchester, Massachusetts
Palo Alto Medical Research Foundation, Palo Alto, California
Panoramic Studios, Philadelphia, Pennsylvania
Parco Scientific Company, Warren, Ohio
Performance Research Incorporated, Washington, D. C.

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Planning Research Corporation, Los Angeles, California
Psychological Research Service, Inc., Austin, Texas
Rand Corporation, Santa Monica, California
Rheem Manufacturing Company, Los Angeles, California
Science Research Associates, Chicago, Illinois
Scott Paper Company, S. B. Sutpin Research Center, South Hadley, Mass.
Simulaids, Inc., Woodstock, New York
The Singer Company, Link Division - Education Systems, Binghamton, N.Y.
* Stanford Research Institute, Menlo Park, California
Synectics, Inc. Cambridge, Massachusetts
Syracuse University Research Corporation, Policy Institute, Syracuse, N.Y.
* Systems Development Corporation, Santa Monica, California
Tracor, Inc., San Diego Laboratory, San Diego, California
Viewlex, Inc., Holbrook, New York
Westinghouse Electric Corporation:
    Behavioral Systems Division, New York, New York
    Learning Aids Division, Pittsburgh, Pennsylvania
    Measurement Research Center, Iowa City, Iowa
    New England Educational Data Systems, Waltham, Massachusetts
    Project Annapolis Division, Annapolis, Maryland
    Project Plan Division, Palo Alto, California

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*On the basis of their replies to the initial letter of inquiry, starred organizations were not sent copies of the questionnaire for non-degree granting institutions, since they had indicated that they offer no RDDE training activities.

APPENDIX M

QUESTIONNAIRES AND COVER LETTERS FOR RESEARCH TRAINING SURVEY

american educational
research association

COVER LETTER FOR Q[1]

Dear Colleague:

The American Educational Research Association is currently conducting a USOE-supported study to identify and describe all formal training programs in educational research and research-related areas in the United States. From the results of the study we will report to USOE on the current status of research training and recommend actions to continue and improve training opportunities for educational researchers.

As part of this effort we are distributing the enclosed questionnaire to key persons in master's and doctoral degree granting institutions. Specifically, we would like to ask you to answer a single question on the enclosed questionnaire and then, depending on your answer, either return it to us or forward it to the appropriate person in your institution.

We would be most grateful if you would take a few minutes to read the definitions at the beginning of the questionnaire. If, on the basis of those definitions, you determine that your institution does not offer a graduate program in educational research and research-related areas, simply check item 1 and return the questionnaire in the enclosed envelope.

If you do have a graduate educational research or research-related program according to our definitions, please forward the questionnaire and this cover letter to the director of the program or to the faculty member who is best able to describe the program. He should then complete the questionnaire, including the information in item 11 concerning his position, and return the questionnaire to us.

Your response is most important to our study; in order to meet our contract deadline, we would be most appreciative if the questionnaire could be returned to us no later than August 9. If you have questions concerning the study, you may contact me at the address indicated on the return envelope.

Sincerely yours,

Blaine R. Worthen

Blaine R. Worthen, Chairman
Task Force on Research Training

1126 SIXTEENTH STREET, N.W. • WASHINGTON, D.C. 20036 • 202/223-9485

M.5

Q^1: QUESTIONNAIRE FOR DEGREE GRANTING INSTITUTIONS

AERA Research Training Study

In this questionnaire, educational research and research-related activities are defined to include (1) educational research, (2) the design and development of instructional products and programs, (3) the dissemination of products and curricula to the educational community, and (4) the evaluation of materials and programs, both as part of the development effort and as an ongoing monitoring process.

Educational researchers and research-related personnel thus include developers and disseminators as well as research methodologists, statisticians, and experts in measurement and evaluation. They also include researchers in substantive fields, such as science education. (Note, however, that such persons are specialists in research in science education, not specialists in science education *per se*.)

1 Given the above definitions, do you have a graduate program for the preparation of educational researchers and/or research-related personnel? That is, do you offer an identifiable field of specialization in educational research, development, diffusion or evaluation--one which is equivalent to other areas of specialization in the department, school or college of education?

(Please check ONE) YES ☐ NO ☐

If you answered NO above, please provide us with your name, position and institution in the space below and return the questionnaire to us in the accompanying envelope.

____

____

If you answered YES above, please forward the questionnaire and cover letter to the program director or other person and ask him to complete items 2 through 11; he may then return the questionnaire to us in the envelope provided.

IN THE REMAINDER OF THIS QUESTIONNAIRE, THE PROGRAM FOR EDUCATIONAL RESEARCHERS AND RESEARCH-RELATED PERSONNEL WILL BE REFERRED TO SIMPLY AS THE EDUCATIONAL RESEARCH PROGRAM.

2 How long has your educational research program been in existence? ________(yrs.)

3 What degrees are offered in the educational research program? (Please check)

MA ____ MS ____ MEd ____ EdD ____ PhD ____ Other (specify) ____

4 How many degree candidates were specializing in educational research at the end of the 1970-71 academic year?

Master's level: full time ____ part time ____

Doctoral level: full time ____ part time ____

5 Please indicate which of the following criteria you consider in determining admission to your educational research program. (Please check one column for each item.)

	Primary Importance	Secondary Importance	No Importance
GRE Total Score (min. acceptable____)	____	____	____
GRE Verbal (min. acceptable ____)	____	____	____
GRE Quantitative (min. acceptable ____)	____	____	____
Miller Analogies Test (min. acceptable ____)	____	____	____
Other standardized test (Please specify ________________)	____	____	____
Undergraduate grade point average (min. ____ on a scale of ____)	____	____	____
Graduate grade point average (min. ____ on a scale of ____)	____	____	____
Recommendations of instructors/employers	____	____	____
Previous course work in particular areas	____	____	____

and development of instructional products and programs, (3) the dissemination of products and curricula to the educational community, and (4) the evaluation of materials and programs, both as part of the development effort and as an ongoing monitoring process.

Educational researchers and research-related personnel thus include developers and disseminators as well as research methodologists, statisticians, and experts in measurement and evaluation. They also include researchers in substantive fields, such as science education. (Note, however, that such persons are specialists in research in science education, not specialists in science education per se.)

1 Given the above definitions, do you have a graduate program for the preparation of educational researchers and/or research-related personnel? That is, do you offer an identifiable field of specialization in educational research, development, diffusion or evaluation--one which is equivalent to other areas of specialization in the department, school or college of education?

(Please check ONE) YES ☐ NO ☐

If you answered NO above, please provide us with your name, position and institution in the space below and return the questionnaire to us in the accompanying envelope.

____

____

If you answered YES above, please forward the questionnaire and cover letter to the program director or other person and ask him to complete items 2 through 11; he may then return the questionnaire to us in the envelope provided.

IN THE REMAINDER OF THIS QUESTIONNAIRE, THE PROGRAM FOR EDUCATIONAL RESEARCHERS AND RESEARCH-RELATED PERSONNEL WILL BE REFERRED TO SIMPLY AS THE EDUCATIONAL RESEARCH PROGRAM.

2 How long has your educational research program been in existence? ________(yrs.)

3 What degrees are offered in the educational research program? (Please check)

MA ____ MS ____ MEd ____ EdD ____ PhD ____ Other (specify) ____

4 How many degree candidates were specializing in educational research at the end of the 1970-71 academic year?

Master's level: full time ____ part time ____
Doctoral level: full time ____ part time ____

5 Please indicate which of the following criteria you consider in determining admission to your educational research program. (Please check one column for each item.)

	Primary Importance	Secondary Importance	No Importance
GRE Total Score (min. acceptable ____)	____	____	____
GRE Verbal (min. acceptable ____)	____	____	____
GRE Quantitative (min. acceptable ____)	____	____	____
Miller Analogies Test (min. acceptable ____)	____	____	____
Other standardized test (Please specify ________________)	____	____	____
Undergraduate grade point average (min. ____ on a scale of ____)	____	____	____
Graduate grade point average (min. ____ on a scale of ____)	____	____	____
Recommendations of instructors/employers	____	____	____
Previous course work in particular areas (Please specify areas ________________)	____	____	____
Previous research experience	____	____	____
Previous school experience	____	____	____
Expressed interest in educational research	____	____	____
Undergraduate major (Please specify ________________)	____	____	____
Age (Please specify ________________)	____	____	____
Interview	____	____	____
Other (Please specify ________________)	____	____	____

6 Please describe the minimum registration requirements for part time students in your program.

_____ credit hours per academic term (Give number of hours)

_____ courses per academic term (Give number of courses)

Academic term (Please check ONE): _____ semester _____ quarter

7 Is a minimum period of full time residence required before the awarding of a degree? YES ☐ NO ☐

If YES, what is the length of that period? ____________________

8 Please indicate which of the following best describes the primary focus of your educational research program, keeping in mind that your response will indicate the major areas in which researchers and research-related personnel are prepared. (It may be necessary to specify more than one area of emphasis, but please limit your choices to those which describe the major orientation of the program.) (Please check the appropriate items.)

_____ Research methodology/design/statistics
_____ Measurement
_____ Evaluation
_____ Administration
_____ Curriculum and instruction
_____ Education subject areas (Please specify ____________________)
_____ Counseling and guidance
_____ Psychology
_____ Vocational education
_____ Special education
_____ History and philosophy of education
_____ Educational product or program development
_____ Dissemination and diffusion of educational materials and programs
_____ Other (Please specify ____________________)

9 For each of the areas below, indicate how many courses are usually required as part of the educational research program.

	Required for Master's (if applicable)	Required for Doctorate (if applicable)
Introduction to educational research	____	____
Advanced research methods	____	____
Statistics	____	____
Computer methods and use	____	____
Testing (use of standardized tests)	____	____
Measurement and test construction	____	____
Evaluation	____	____
Curriculum and instruction	____	____
Educational administration	____	____
Research management	____	____
Communications	____	____
Marketing	____	____
Politics or finance of education	____	____
Educational change and change strategies	____	____
Product development	____	____
Instructional sequencing	____	____
Psychology	____	____
Sociology	____	____
History/philosophy of education	____	____
Other (Please specify ____________________)	____	____

10 Which one or more of the following types of experience are part of your educational research program? (Please check the appropriate column.)

Required	Available	
		Assistantship or internship within your program
____	____	(a) Assistance across several projects or programs
____	____	(b) Assignment to a particular project or program
		Assistantship or internship in a campus research unit outside your own program
____	____	(a) Assistance across several projects or programs
____	____	(b) Assignment to a particular project or program
____	____	Assistantship or internship in an off-campus unit (Please describe ____________________)
____	____	Apprenticeship to a senior researcher, but not for a specific project or projects

which of the following best describes the primary focus of your educational research program, keeping in mind that your response will indicate the major areas in which researchers and research-related personnel are prepared. (It may be necessary to specify more than one area of emphasis, but please limit your choices to those which describe the major orientation of the program.) (Please check the appropriate items.)

_____ Research methodology/design/statistics
_____ Measurement
_____ Evaluation
_____ Administration
_____ Curriculum and instruction
_____ Education subject areas (Please specify _______________)
_____ Counseling and guidance
_____ Psychology
_____ Vocational education
_____ Special education
_____ History and philosophy of education
_____ Educational product or program development
_____ Dissemination and diffusion of educational materials and programs
_____ Other (Please specify _______________)

9 For each of the areas below, indicate how many courses are usually required as part of the educational research program.

	Required for Master's (if applicable)	Required for Doctorate (if applicable)
Introduction to educational research	____	____
Advanced research methods	____	____
Statistics	____	____
Computer methods and use	____	____
Testing (use of standardized tests)	____	____
Measurement and test construction	____	____
Evaluation	____	____
Curriculum and instruction	____	____
Educational administration	____	____
Research management	____	____
Communications	____	____
Marketing	____	____
Politics or finance of education	____	____
Educational change and change strategies	____	____
Product development	____	____
Instructional sequencing	____	____
Psychology	____	____
Sociology	____	____
History/philosophy of education	____	____
Other (Please specify _______________)	____	____

10 Which one or more of the following types of experience are part of your educational research program? (Please check the appropriate column.)

Required	Available	
		Assistantship or internship within your program
____	____	(a) Assistance across several projects or programs
____	____	(b) Assignment to a particular project or program
		Assistantship or internship in a campus research unit outside your own program
____	____	(a) Assistance across several projects or programs
____	____	(b) Assignment to a particular project or program
____	____	Assistantship or internship in an off-campus unit (Please describe _______________)
____	____	Apprenticeship to a senior researcher, but not for a specific project or projects
____	____	Technical consultant services for faculty, students and administrators
____	____	Other research experience (Please describe _______________)

11 TO BE COMPLETED BY ALL RESPONDENTS:

Name and Position _______________

Department and Institution _______________

Field of specialization _______________

M.7

LETTER OF INQUIRY TO SELECTED NON-DEGREE GRANTING ORGANIZATIONS

UNIVERSITY OF COLORADO
BOULDER, COLORADO 80302

LABORATORY OF EDUCATIONAL RESEARCH

Dear Sir:

The American Educational Research Association's Task Force on Research Training is currently engaged in a study of the educational community's need for personnel to conduct research and research-related activities in education. From the results of this study the Association intends to make recommendations to the U. S. Office of Education for the training and retraining of research personnel.

As part of this endeavor we need to know what formal opportunities exist for the training of educational researchers and related personnel. Most such opportunities will be found in college and university departments of education. It has come to our attention, however, that other institutions and organizations -- among them the state education departments -- often provide somewhat different kinds of training in the form of institutes and workshops on research topics. There may also be more extensive, though still short-term, training of personnel for particular research-related projects (for example, the evaluation of programs conducted under Titles I and III of the Elementary and Secondary Education Act of 1965). In addition seminars are sometimes held specifically to disseminate information on new research results or the application of new techniques.

We regard all of these as important elements in the training of educational researchers and wish to include them, along with the degree-granting programs, in our overall description of training opportunities. For this reason we are asking you to provide us with a list of research and research-related training activities which are supported or administered by the department of education for your state. We will also need to know the name of a person to contact for more detailed information on each training program.

In order to meet our project deadline, we would like to receive the preliminary information by June 7. We greatly appreciate any help you are able to give us.

Yours sincerely,

american educational
research association

COVER LETTER FOR Q^2

Dear Colleague:

The American Educational Research Association is currently conducting a USOE-supported study to identify and describe all formal training programs in educational research and research-related areas in the United States. From the results of the study we will report to USOE on the current status of research training and recommend actions to continue and improve training opportunities for educational research and research-related personnel.

As part of this effort, we are distributing the enclosed questionnaire to key persons within those agencies and organizations concerned with educational research and research-related activities. Specifically, we would like to ask you to answer a single question on the questionnaire and then, depending on your answer, either return it to us or complete the remaining nine items.

We would be most grateful if you would take a few minutes to read the definitions and descriptions at the beginning of the questionnaire. If you determine that your organization does not offer training of the type described, simply complete item 1 and return the questionnaire in the enclosed envelope. If you do offer training opportunities of the type described, please complete items 2 through 10 and return the questionnaire to us.

Your response is most important to our study; in order to meet our contract deadline, we would be most appreciative if the questionnaire could be returned to us no later than August 16. If you have questions concerning the study, you may contact me at the address indicated on the return envelope.

Sincerely yours,

Blaine R. Worthen

Blaine R. Worthen, Chairman
Task Force on Research Training

1126 SIXTEENTH STREET, N.W. • WASHINGTON, D.C. 20036 • 202/223-9485

Q^2: QUESTIONNAIRE FOR NON-DEGREE GRANTING ORGANIZATIONS

AERA Research Training Study

In this questionnaire, training in educational research and research-related areas is defined to include training in (1) educational research, (2) the design and development of instructional products and programs, (3) the dissemination of products and curricula to the educational community, and (4) the evaluation of materials and programs, both as part of the development effort and as an ongoing monitoring process. (These areas are jointly designated as educational RDDE.)

This study is aimed at learning what training opportunities in the above-mentioned areas an employee or member or other interested person might expect to encounter through your organization.

The kinds of training opportunities under investigation include those training vehicles (such as seminars and workshops) which are a scheduled and ongoing part of the overall activities of the organization. To this extent, they may be considered "formal" training activities, as opposed to the less structured, day-to-day training of an employee which takes place naturally through his exposure to the projects and people around him.

The questions which follow pertain only to the scheduled and ongoing training activities which your organization makes available.

1 Does your organization offer training opportunities of the type described above in educational RDDE (research, development, dissemination and evaluation)? (Please check ONE.)

YES ☐ NO ☐

If you answered NO above, please provide your name, title, and the name of your organization in the space below and return the questionnaire in the enclosed envelope.

Name & Title ______________________________

Organization ______________________________

If you answered YES above, please complete items 2 through 10 and return the questionnaire in the envelope provided.

---

2 Given the types of training activities listed in the first column below, please provide the indicated information for each activity which your organization regularly (e.g., weekly, annually) offers in educational RDDE subjects.

Type of Training Activity	Frequency of Training Activity (e.g., weekly)	Normal Duration of the Activity (e.g., 3 days)
Lectures		
Seminars		
Workshops		
Conferences		
Institutes		
Other*		

* See item 8 for questions on internship activities. Do not include internships here.

3 Please indicate below the limitations which apply to participation in the RDDE training activities regularly offered by your

development of instructional products and programs, (3) the dissemination of products and curricula to the educational community, and (4) the evaluation of materials and programs, both as part of the development effort and as an ongoing monitoring process. (These areas are jointly designated as educational RDDE.)

This study is aimed at learning what training opportunities in the above-mentioned areas an employee or member or other interested person might expect to encounter through your organization.

The kinds of training opportunities under investigation include those training vehicles (such as seminars and workshops) which are a scheduled and ongoing part of the overall activities of the organization. To this extent, they may be considered "formal" training activities, as opposed to the less structured, day-to-day training of an employee which takes place naturally through his exposure to the projects and people around him.

The questions which follow pertain only to the scheduled and ongoing training activities which your organization makes available.

1 Does your organization offer training opportunities of the type described above in educational RDDE (research, development, dissemination and evaluation)? (Please check ONE.)

YES ☐ NO ☐

If you answered NO above, please provide your name, title, and the name of your organization in the space below and return the questionnaire in the enclosed envelope.

Name & Title ____________________

Organization ____________________

If you answered YES above, please complete items 2 through 10 and return the questionnaire in the envelope provided.

---

2 Given the types of training activities listed in the first column below, please provide the indicated information for each activity which your organization regularly (e.g., weekly, annually) offers in educational RDDE subjects.

Type of Training Activity	Frequency of Training Activity (e.g., weekly)	Normal Duration of the Activity (e.g., 3 days)
Lectures		
Seminars		
Workshops		
Conferences		
Institutes		
Other*		

* See item 8 for questions on internship activities. Do not include internships here.

3 Please indicate below the limitations which apply to participation in the RDDE training activities regularly offered by your organization. (Please check the appropriate column for each relevant activity.)

Type of Training Activity	Open to Members/ Employees Only	Open to Limited Outside Participants	Open to Anyone Interested
Lectures			
Seminars			
Workshops			
Conferences			
Institutes			
Other			

522

M.10

4 In general, is a fee required for participation in the training offered by your organization?

YES ☐ NO ☐

If YES, please estimate the average fee charged per person $____

If NO, or if fees do not fully cover expenses of the training, how is the program funded? (Please check ONE.)

___ Primarily by your organization

___ Primarily by outside sources (Please specify ________________)

___ About equally by organizational and outside support (Please specify ________________)

5 In general, who are the instructors in your organization's training activities? (Please check any which apply.)

___ Staff members from within your organization

___ Persons from outside your organization, but not college or university faculty

___ College or university faculty from outside your organization

6 What is the major objective of your organization in providing training activities? (Please check ONE.)

___ To inform participants of new developments in their fields

___ To raise the aspirations of staff or members in relation to new techniques or subjects

___ To update the training of the participants in subjects which they have previously studied

___ To provide in-depth training in subjects which are new to the participants

7 Please list below the topics which have been covered by training workshops, seminars, etc. in your organization in the past year or which are planned for presentation in the coming year (e.g., statistical methods or techniques, proposal development, research management). Also indicate for each topic whether it was (or will be) presented as a lecture (L), seminar (S), workshop (W), conference (C), or institute (I).

________________ ________________

________________ ________________

________________ ________________

8 Does your organization work cooperatively with colleges or universities to offer formal internship opportunities for degree or postdoctoral students in educational research and research-related areas?

YES ☐ NO ☐

If YES, with what colleges and universities have internship arrangements been made in the past three years?

____

____

9 If your organization employs personnel in educational research and research-related areas, please indicate which of the following benefits are available to those who wish to take credit courses in an accredited college or university. (Please check any item which applies.)

___ Tuition for employees is paid by your organization only for courses directly related to their work in your organization.

___ Tuition for employees is paid by your organization for any course in the employee's degree program.

___ No tuition for employees is paid by your organization.

specify ____________________)

5 In general, who are the instructors in your organization's training activities? (Please check any which apply.)

___ Staff members from within your organization

___ Persons from outside your organization, but not college or university faculty

___ College or university faculty from outside your organization

6 What is the major objective of your organization in providing training activities? (Please check ONE.)

___ To inform participants of new developments in their fields

___ To raise the aspirations of staff or members in relation to new techniques or subjects

___ To update the training of the participants in subjects which they have previously studied

___ To provide in-depth training in subjects which are new to the participants

7 Please list below the topics which have been covered by training workshops, seminars, etc. in your organization in the past year or which are planned for presentation in the coming year (e.g., statistical methods or techniques, proposal development, research management). Also indicate for each topic whether it was (or will be) presented as a lecture (L), seminar (S), workshop (W), conference (C), or institute (I).

____________________ ____________________

____________________ ____________________

____________________ ____________________

8 Does your organization work cooperatively with colleges or universities to offer formal internship opportunities for degree or postdoctoral students in educational research and research-related areas?

YES ☐ NO ☐

If YES, with what colleges and universities have internship arrangements been made in the past three years?

____

____

9 If your organization employs personnel in educational research and research-related areas, please indicate which of the following benefits are available to those who wish to take credit courses in an accredited college or university. (Please check any item which applies.)

___ Tuition for employees is paid by your organization only for courses directly related to their work in your organization.
___ Tuition for employees is paid by your organization for any course in the employee's degree program.
___ No tuition for employees is paid by your organization.

___ Employees have time off with pay to attend classes directly related to their work in your organization.
___ Employees have time off with pay to attend classes in their degree program.
___ No time off with pay is given for class attendance by employees.

10 In the space below, please give the name and title of the person within your organization who may be contacted by those wishing additional information concerning research training activities.

Name & Title ________________________________

Organization ________________________________

M.11

american educational
research association

Q^1 FOLLOW-UP LETTER

August 11, 1971

Dear Colleague:

Some weeks ago we sent you a brief questionnaire to collect data concerning training programs in educational research and research-related areas. We regret having to bother you again, but to date we have not received a response from you.

We would be most grateful if you would take a few minutes to read the definitions at the beginning of the enclosed questionnaire. If, on the basis of those definitions, you determine that your institution does not offer a graduate program in educational research and research-related areas, simply check item 1 and return the questionnaire in the enclosed envelope.

If you do have a graduate educational research or research-related program according to our definitions, please forward the questionnaire and this cover letter to the director of the program or to the faculty member who is best able to describe the program. He should then complete the questionnaire, including the information in item 11 concerning his position, and return the questionnaire to us.

Your response is most important to our study, and the value of the investigation will be seriously reduced unless a much higher percentage of responses is received. We would like to request again that you complete and return the questionnaire.

We will be grateful for your cooperation and assistance.

Sincerely,

Blaine R. Worthen

Blaine R. Worthen, Chairman
Task Force on Research Training

BRW/lg

Enclosures

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M.12

american educational
research association

Q^2 FOLLOW-UP LETTER

August 26, 1971

Dear Colleague:

Some weeks ago we sent you a brief questionnaire to collect data concerning training activities in educational research and research-related areas. We regret having to bother you again, but to date we have not received a response from you.

We would be most grateful if you would take a few minutes to read the definitions at the beginning of the enclosed questionnaire. If, on the basis of those definitions, you determine that your organization does not offer training of the type described, simply fill in item 1 and return the questionnaire in the enclosed envelope. If you do offer training opportunities of the type described, please complete items 2 through 10 and return the questionnaire to us.

Your response is most important to our study, and the value of the investigation will be seriously reduced unless a much higher percentage of responses is received. We would like to request again that you complete and return the questionnaire.

We will be grateful for your cooperation and assistance.

Sincerely,

Blaine R. Worthen

Blaine R. Worthen, Chairman
Task Force on Research Training

BRW/mb

Enclosures

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APPENDIX N

SOME ARGUMENTS AGAINST CONSIDERING RETRAINING OF UNEMPLOYED DOCTORATES IN UNRELATED FIELDS AS A MAJOR SOURCE OF SUPPLY OF EDUCATIONAL RDDE PERSONNEL

N.3

Some Arguments Against Considering Retraining of Unemployed Doctorates in Unrelated Fields as a Major Source of Supply of Educational RDDE Personnel

It was suggested by the deans surveyed by Phi Delta Kappa that current educational RDDE training programs be expanded to meet the need for more trained RDDE personnel (Robertson & Sistler, 1971, p. 63). It has been proposed by other persons, however, that unemployed Ph.D.'s from fields outside education are a prime recruitment group to meet the need for trained personnel in educational research, development, diffusion, and evaluation. Those who support the idea of re-training unemployed Ph.D.'s argue (1) re-training would provide the trained manpower needed without expanding an already too large capacity for training Ph.D.'s, (2) re-training the already trained would be faster and more economical, and (3) re-training trained persons who are without jobs is a better use of human resources than upgrading the training of persons who are already employed.

A study conducted by Dean and others identified several barriers to implementing that strategy, however. For one thing, no large-scale retraining efforts are in operation now, and none are anticipated for the near future. The few retraining programs now in existence are very expensive; there is a one year master's level retraining program at Stanford University which costs over $10,000 per student to conduct. It is unknown at the present time where the funding would come from for such expensive programs. Also, there are many unanswered questions about ultimate placement for these retrained Ph.D.'s. Will there be a job for a retrained person who has previously specialized in another field? (Dean, *et al.*, 1971, p. 17)

Even if these barriers could be eliminated, there would still be the question of whether a person who has devoted the time necessary to obtain a Ph.D. in one field would be willing to give that up and start over again in another field (and perhaps end up in a lower status position, at that; such would be the case if a Ph.D. entered the retraining program at Stanford).

For the sake of efficiency (so that the persons being retrained would not have to spend as much time in a training program as would persons entering graduate work for the first time), the retraining programs should be tailored to fit personnel previously in specific fields, e.g., engineers. Designing and developing a tailored retraining program for engineers would be expensive and time-consuming, but it could be done. The question is, would the expense and the time be worth it? Would the job market have corrected itself so that supply and demand would have returned to a state of balance in a particular field such as engineering by the time a retraining program for engineers could be designed? There is no way to predict that. Even if a retraining program could be designed, would it be very widely used once it was developed? Designing the program is but a small part of the work; it must also be disseminated and adopted, and the diffusion/adoption pattern as used now is not very impressive.

Therefore, as a result of these barriers and questions, it is the opinion of the author that retraining unemployed Ph.D.'s from fields other than education is not one of the better strategies for preparing persons to work in educational RDDE.

APPENDIX O

STUDIES INCLUDED IN THE SYNTHESIS OF RESEARCH RESULTS ON THE TRAINING OF RESEARCH AND RESEARCH-RELATED PERSONNEL IN EDUCATION

0.3

STUDIES INCLUDED IN THE SYNTHESIS OF RESEARCH RESULTS ON THE TRAINING OF RESEARCH AND RESEARCH-RELATED PERSONNEL IN EDUCATION

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Worthen, B. R. A re-analysis of normative data from the National Register of Educational Researchers: Implications for research training. In Clark, D. L. & Hopkins, J. E., A report on educational research, development and diffusion manpower, 1964-1974. Bloomington: Indiana University, 1969.

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